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EDITORIALS

ELIHU THOMSON.

Under the heading of "A Great American," the *New York Times* last Sunday published an interesting and discriminating editorial review of the achievements of Prof. Elihu Thomson, the distinguished electrical engineer and inventor. We take pleasure in republishing this editorial in large part, and believe no words of commendation were ever more worthily bestowed:

"Elihu Thomson, English by birth, is an American citizen of whom the United States will boast hereafter. He is of the minds, few in every generation, that produce a great and lasting effect upon national welfare and industrial progress, that fructify civilization by the originality of their thought and their scientific achievement.

"Only the other day Dr. Thomson, who wears modestly the laurels of we don't know how many native and foreign societies, received the medal of the Royal Society of London. On Friday night the John Fritz medal was given to him. President Maclaurin of the Massachusetts Institute of Technology, of the corporation of which Dr. Thomson is a member, mentioned his five hundred-odd patents, 'a large number of them embodying principles so wide in their application that they might almost be classed as physical laws,' his master discovery of electric welding, 'one of the great inventions of the last generation,' and so on. Greater than the work, though, is the man; and not merely by the number and brilliance of his inventions, not merely because of his contributions to electrical engineering, the applied science perhaps most characteristic of this age, is Elihu Thomson great. He has not been content to dwell apart in that region of creative imagination which is the mathematician's, the astronomer's. The fact, uncommon, and one would have thought all but impossible, in this apotheosis of specialization, that his scientific interest and knowledge have the widest scope and range, has not engrossed him and confined him to the cultivation of his own powers. In his youth he was a teacher in the Central High School of Philadelphia. He has not ceased to teach, and more productively than he could hope to do in a university. * * * Thus by helpfulness to others as well as by his own labors he furthers that scientific research the economic necessity and value of which the war is impressing upon this country, laggard before it in spite of the shining example of Germany."

The award to Dr. Thomson of the John Fritz medal at the Boston meeting of the American Institute of Electrical Engineers is referred to upon another page of this issue.

SPARE THE LITTLE ONES.

Christmas will soon be with us now, Christmas, the time of all times. Christmas is children's time, whether in the palace of the millionaire or the hovel of the pauper. Does not the very word stir up old-time memories of our childhood days in the hearts of the oldest of us? Christmas means joy for the children; it means the tinkle of bells and the coming of Santa Claus; it means Christmas trees and stockings and gifts; it means a time of rejoicing and happiness, of suspense and surprises; it means the joy of receiving and the greater joy of giving. Yes, surely, Christmas is children's time, for what would it be without the echo of childish laughter and the patter of tiny feet?

But as every Christmas brings its harvest of happiness and joy, so also does it bring sorrow and misery and despair. Each year, invariably as the seasons come and go, Christmas claims its toll of little victims, little child-lives brought to a sudden close in the springtime of their years. Each year, somewhere, sometime, when the festive dance and the Christmas celebrations are in full swing comes tragedy; whilst little ones romp and play, innocent of the danger ever lurking, forgetful in the abandonment of the excitement of a first Christmas tree perhaps, conscious of nothing save the joy of living, death hovers. Suddenly, above the sound of laughter and merry-making, rises the scream of pain and fear and the shriek of the panic-stricken. Flames leap up, darting here and there amongst the festoons with lightning speed, seeking what they can devour; lamps and trees and holly, and little human Santa Claus become fuel to the flame, and tiny, happy, throbbing childish bodies are turned to charred corpses.

Thus it is every year, year after year. Rejoicing and merriment turn to wailing and agony and mourning; laughter turns to tears, and homes so recently reverberating with childish glee are made empty, silent and desolate, knowing no more the sound of childish laughter or the call of little ones at play. In a few brief, terrible moments homes are emptied, hearts are broken and little lives are finished ere they have barely begun.

In many homes this coming Christmas little ones will romp and play, tempting death, whilst their elders watch, not heeding, until too late. It will not be very long now before we hear of the Yuletide tragedies, of those for whom Christmas will never come again. The pity of it, when it is so useless, so needless, and so sad!

We ask all those who are able to preach against the use of the naked flame for interior decorations in connection with Christmas trees and festoons and in close

proximity to inflammable costumes. Preach against the use of the candle and naked flame and work for its substitute, the electric light. Push the sale of the tiny electric lamp at a price that will place it within reach of all, for humane, not mercenary, motives. Publish the dangers accompanying the use of the candle and naked flame, that all may be forewarned. Carry this safety campaign broadcast out far into your territories, beyond those who have electric service, that the ignorant may know and the careless be warned. Substitute for the naked flame the electric light where possible, but warn all, that the annual toll may be reduced.

Spare the little ones. "Do it electrically." Never was there greater incentive to do anything electrically than that of interior Yuletide decorations. Surely never was nobler work for the central-station company to do than now. Spare the little ones! Let the little ones have their fun—there are too few real Christmases in the childhoods of all of us—but make it safe. Do it electrically. Eliminate the naked flame. Substitute the electric light!

STANDARDIZATION AND ASSOCIATION.

For those doubting souls who are skeptical as to the advantages of standardization and of associations offering opportunity for co-operative effort by those engaged in the same industry, we should like to make reference to the address of Mr. E. R. Harding, president of the Electric Power Club, at a recent meeting of that association. After pointing out the wrong and the insufficiency of combinations formed for price fixing and similar agreements, Mr. Harding emphasized the benefits which come out of an association of those engaged in any industry who co-operate for their common welfare and standardize the processes of manufacture. He told the members that when they standardize the electrical performance of a motor they are standardizing a commensurate profit on the motor; that when they standardize the mechanical design and limits of a motor they are stabilizing the market price on the motor; that when they standardize equitable commercial practices in the industry they are protecting the financial integrity of the corporations; and that when they develop uniform cost-accounting systems along scientific lines they are putting the whole motor industry on a sound financial basis.

These things can only be accomplished by the co-operation which is made possible through the acquaintance and association brought about by meeting together as members of an organization which has these and similar aims as its object in existence. The problems must be studied together before standardization is possible and until costs are accurately known prices cannot be stabilized. An industry as a whole cannot work to its fullest benefit without co-operation and interchange of ideas of the people in the industry. An association provides the means by which experiences may be discussed, investigations made and unity of action taken. An association for each industry is essential to the economic, moral and financial success of such industry. These pronouncements of Mr. Harding deserve careful study on the part of those who are interested not only in the present prosperity but in the future welfare of the industry.

GETTING FULL VALUE FROM COAL.

We usually think of coal as a source of heat and through the utilization of its heat as a source of power. But this is not its only value. By the proper utilization of coal, value may also be obtained from by-products which are entirely wasted in the ordinary methods of combustion. By-products have mostly been obtained from coal through the medium of plants for producing illuminating gas and from power gas producers. By-product coke ovens have lately formed another important avenue for the conservation of these values, but in the beehive type of oven, which was formerly more general, the by-products were entirely lost.

In the application of coal to the production of power in steam generating plants, the possibility of obtaining by-products has usually not been considered. It is recognized that it would be possible to obtain by-products in the case of such use, but it has generally been considered that the capital investment required to do so would be prohibitive. It now seems likely that such a conclusion is due to an insufficient investigation of the possibilities. It is claimed by an English electrical engineer that a steam boiler has been recently designed which at moderate cost will enable the by-products from the coal to be saved. The scheme involves the use of a retort for the distillation of the coal and the passage of both the resulting coke and the treated gas into the furnace, which heats the retort and the steam boiler simultaneously. The tar and ammoniacal liquor are extracted from the gas before it passes to the furnace, and the by-products are obtained from these.

If this process can be carried out with sufficient economy, it should meet with general adoption. The necessity of conserving whatever supplies of nitrogen may be available in this country have received great emphasis during the past two years, and have come to be generally recognized. Nitrogenous compounds are indispensable in time of war as a basis for the manufacture of explosives and hence every nation should be, so far as possible, independent of others in their production. In times of peace the value of nitrogenous compounds is equally great, as they can be utilized in fertilizers, dye-stuffs and other products which are not only important, but may some day become absolutely essential to national prosperity. It has been claimed that there is sufficient nitrogen contained in the coal now used in this country to meet the entire need of the country for this class of products and it is thus evident that a proper recovery and utilization of this constituent of the coal deposits would give the nation a material the supply of which has caused so much uneasiness in many quarters in connection with preparedness for possible war.

FUSES AND WIRING DEVELOPMENTS.

The grounding of some point of electrical circuits, and especially of the low-potential circuits used for indoor service, has steadily grown in favor. The National Electrical Code requires the grounding of the neutral wire of three-wire direct-current circuits, and of the neutral wire or one outside wire of low-potential alternating-current circuits. The 1915 edition of the Code made mandatory the exclusion of fuses from the grounded service wire, which formerly was optional. It requires, however, both sides of branch circuits to be fused where two-wire circuits are run to the lamp sockets or other consuming devices. Except in such two-wire branch circuits, fuses are not permitted in any permanently grounded wire. The object of this requirement is obviously to avoid the likelihood of the interruption of the ground connection to any wire which is nominally grounded. On a branch circuit nothing but the circuit itself is dependent upon maintaining the ground connection undisturbed and the framers of the Code evidently believed that the additional protection furnished by a second fuse is justified in this case. It should be noted, however, that if the fuse in the grounded wire be blown by an overload, while the other fuse remains intact, the supposedly grounded side of the circuit becomes raised to the maximum potential. This may easily have undesirable consequences, especially if fixtures or other exposed parts are grounded on this side of the circuit. This condition may easily arise and it suggests the desirability of omitting the fuse on the grounded wire even in the two-wire branch circuits.

In the past it was customary to place fuses in all wires, whether grounded or not, but this is now recognized as poor practice. It may be noted that the rules require service switches and switches controlling motors and heaters to open all the wires of a circuit, including the grounded wire. This can do no harm, since the entire circuit is thus left dead. It is considered by some, however, that the requirement that a switch shall open the connection in the grounded wire is superfluous.

The provision of special lines of fittings to meet the requirement of an unbroken grounded wire has lagged somewhat behind the development of the Code rules. Many of the present lines of fittings were developed to meet the old requirements and are not well adapted to present standard practice. This need will undoubtedly soon be met by the manufacturers to the satisfaction of all, but the subject is still in the developmental stage. The expense of inspection departments in applying the present rules and in bringing about changes in existing installations to comply with them, as well as the development of new lines of fittings by the manufacturers, constitute a subject of much interest to all who are concerned with the development of American wiring practice. This practice is still in the formative stage, and the present possibilities of radical changes in the rules, such as would be necessary to make permissible the application of concentric wiring or substitutes which would be superior to it, make future developments a subject for much speculation.

ELECTRIC PROPULSION FOR BATTLESHIPS.

Establishment of the superiority of electric drive for battleship propulsion has about reached the point where it is no longer debatable, as the facts learned from experience are incontrovertible. Naval engineers are constantly in search of better efficiency and economy, along with which driving gear must be reliable, while flexibility and space occupied are important considerations. Electric drive for propellers permits their operation at the most efficient speed, which is necessarily low, while application of the steam turbines to generating electricity permits their operation at high speed without interruption for reversing or slowing down the ship's motion. The geared turbine not only has speed limitations, but requires a separate turbine for backing.

The advantages of electric propulsion were emphasized in a paper presented by Lieut.-Comm. H. C. Dinger before the Philadelphia Section of the American Society of Mechanical Engineers and published in the *Journal* of the Society. He recited the following points of advantage for electric drive: (1) There is much more flexibility so far as arrangement and shaft and piping connections are concerned. (2) Better economy at cruising ranges is secured. (3) Generator rooms, boilers, piping, etc., can be more adaptably arranged. The necessity for bringing large steam pipes through boiler compartments and back to the engine room is avoided, electric conductors taking the place of these large pipes. (4) Parts of machinery can be undergoing repair while other parts are in operation at a very large percentage of the total power of the vessel. (5) Much better handling conditions are secured, and a greatly improved power for backing is present without the complication caused by the use of backing turbines. (6) It is entirely practicable to use a high degree of superheat.

For light, high-powered vessels of the destroyer or scout type, the author considered the geared turbine more suitable, on the ground of weight and compactness. The latter is slightly more economical at top speed, but the reverse is true at cruising and intermediate speeds. The geared turbine must be slowed down for cruising and hence operated at lessened efficiency, whereas with electrical gear the only change is in the speed of the motors. The geared turbine does not permit of as much protection to the machinery and facility for repairs is not as great since the entire plant must be run as a whole. With the electrical equipment there can be no racing of the propeller, since the motor speed is independent of the load. Moreover repairs with electrical equipment have been shown to be small on the vessels already in service.

The Ljungström turbogenerator is expected to make an improvement of some 10 per cent in efficiency, but it has not been tried yet in the Navy. The trials that have been made have conclusively demonstrated the superiority of the electric drive in enough respects to warrant its adoption in the majority of the battleships for which contracts are being let this winter.

Happenings in the Industry

Rupturing Capacity of Oil Circuit-Breakers Discussed at Boston A. I. E. E. Meeting Fritz Medal Awarded—Independent Telephone Men Discuss Their Problems in National Convention—Linking Science With Art in Lighting Practice—Recommendations for Seattle to Abandon Plans for Waterpower Development—Miscellaneous News Notes

RUPTURING CAPACITY OF OIL CIRCUIT-BREAKERS AND PRESENTATION OF THE FRITZ MEDAL.

Monthly Meeting of the American Institute of Electrical Engineers.

The 327th meeting of the American Institute of Electrical Engineers was held at the Massachusetts Institute of Technology, Boston, on December 8 under the auspices of the Boston Section and the Committee on Protective Devices. The morning was devoted to trips of inspection and to committee meetings. In the afternoon a technical session was held and in the evening, following an informal dinner at the Riverbank Court, the presentation of the John Fritz medal was made to Elihu Thomson.

President H. W. Buck occupied the chair at the afternoon session, at which two papers were presented. The first paper was by Stephen Q. Hayes and was entitled "Rupturing Capacities of Oil Circuit-Breakers." The second paper was by E. M. Hewlett and was entitled "Rating of Oil Circuit-Breakers." The paper of Mr. Hayes consisted of a series of notes dealing with the question of rupturing capacity. The term "ultimate rupturing capacity" as usually employed by American switchgear manufacturers has been applied in such a manner that the rating means the maximum size of system on which the circuit-breaker could be safely used. It has been standard practice to assume that the breaker is connected directly to the busbars and may have to open any amount of current that can be received from the bus in case of a short-circuit just beyond the breaker. A circuit-breaker can only open a definite amount of power at the arc. The figures given for the rupturing capacity are dependent upon whether they are in terms of the maximum current and voltage or the root-mean-square values. Since a breaker cannot operate instantaneously, it is never called upon to open the momentary short-circuit current, but it has to be strong enough mechanically to resist the stresses set up during such a short-circuit. By the time rupture takes place the value of the current will be diminished. The kilovolt-ampere rating given should be that which the breaker is guaranteed to open and be immediately reoperative without the necessity of replacement of oil or adjustment of contacts. The ratings usually assigned are based on listed voltage and a change in voltage will change the kilovolt-ampere rating in about the same percentage, but inversely; that is, a decrease in voltage increases the ampere rating. If the parts are properly proportioned the rupturing capacity may be considered as a function of the tank dimensions.

Rating of Oil Circuit-Breakers.

Mr. Hewlett, in his paper, said that the variable factors entering into the rating of oil circuit-breakers make it a difficult problem. In smaller capacities it has been possible to determine definitely the rupturing capacity; larger sizes must be constantly developed, the ratings of which cannot be based on actual past service and are too large for experimental determination. Hence ratings are based mainly upon judgment arising from past experience. Ideal ratings would be on the basis of the current actually opened in the arc at the operating voltage of the system, but in a rational design other factors must be considered, such as power-factor and voltage regulation of the system. Oil circuit-breakers for small stations and industrial service are often used by men who should not be called upon to figure the current and voltage values and for these conditions a kilowatt rating is most convenient in terms of the total generating capacity of the system. Some users require a circuit-breaker to open severe short-circuits without indication of distress. Others are satisfied if the more costly machinery is protected, even though the circuit-breaker itself is destroyed in doing so. Still others expect the circuit-breaker to open two or three times without inspection or repair.

The discussion was opened by Chester Lichtenberg, who said that standardization of rating is becoming a necessity, as operating companies have difficulty in choosing suitable circuit-breakers from among those offered by the manufacturers. He suggested that the rating be based upon the average of the root-mean-square values of the current peaks during the time that the arc persists. He objected to the suggestion of Mr. Hayes that the voltage rating be the value that occurs immediately after the breaker opens. This makes it dependent upon the characteristics of the system to which it is connected and is therefore objectionable. A rating of the rupturing capacity should include a statement of the power-factor on which it is based and the point of the current wave at which the arc is started.

N. L. Pollard said that the rating should be either in kilovolt-amperes or directly in amperes and volts. It should refer to such operation that the breaker can go back into service again after breaking the circuit without showing distress. The manufacturer should give a definite rating and leave it to the user to decide whether it fills his need. It should be capable of breaking the circuit at least three times in succession and still be in good condition.

George A. Burnham said that the manufacturers were in accord in rating oil circuit-breakers but that there is difficulty in selecting proper terms to express the method. He objected to using the word "arc" in the definition since the arc has an influence on the potential as well as the current. The present statement in the Standardization Rules is definite. The circuit-breaker should be fit to go back into service after operating.

John L. Harper said that the manufacturer had two classes of customers to consider, one of which wants a switch which will just do the work and no more, while the other wants one which will always open and be ready to go back into service regardless of its cost.

H. W. Buck said that an oil switch to successfully operate within its rating should be able to go immediately back into service. What constitutes a successful operation of a circuit-breaker should be clearly defined.

C. M. Green said that a circuit-breaker should be able to continue opening the circuit indefinitely under conditions within its rating. He referred to experience with arc-lighting generators and the lightning arresters used with the old arc lamps and with magnetite arc lamps. This showed that the character of the load had a great deal to do with satisfactory operation.

John B. Taylor objected to taking maximum value of current and root-mean-square value of voltage to combine in a rating. He thought the theory of operation should be more fully discussed since at the present time there is confusion in the terms used. If designers agreed upon the factors which determine successful operation the question of rating would be easier.

K. C. Randall compared circuit-breaker design to that of

transformers and motors which were originally designed by comparison but are now built scientifically. It is not known at present how the capacity of a switch varies with tank dimensions and other variables and consequently an exact rating cannot be stated in terms of power-factor, current and voltage. We should stick to the current flowing in the circuit, the normal voltage of the circuit and later, when we have sufficient knowledge, introduce the power-factor. Smoke, throwing oil and soiling of cells do not prove the near approach to maximum rupturing capacity, but with adjustments right such demonstrations should be rare. It is for the purchaser to decide whether a unit should go back into operation and the manufacturer will build whatever the purchaser chooses to buy.

H. R. Summerhayes pointed out that low-voltage switches are usually used in stations centrally located in large cities where space is expensive and that they are consequently made as compact as possible. With high-voltage switches one is not usually so limited in space or in investment and consequently they have been designed with larger factors of safety and usually show better performance. He favored rating switches on the current which the switch opens and the system voltage. Ability to return to service at least once should be adopted as standard practice.

Paul M. Lincoln referred to the different short-circuit values for the current in different types of generator and favored a rating in terms of the maximum current which the circuit-breaker can interrupt rather than its normal current-carrying capacity.

Comfort A. Adams compared the development in the rating of machinery with that of oil circuit-breakers. We have not yet reached the point where we can make such a definite rating of the latter as of the former, but we should adopt a rating which is independent of the system to which it is connected and it should be a definite value. Others who discussed the paper were L. E. Imlay and L. W. Chubb. The discussion was then closed by Mr. Hayes and Mr. Hewlett.

Award of Fritz Medal to Elihu Thomson.

At the evening session the chair was occupied by Albert Sauveur, chairman of the John Fritz Medal Board of Award. He first introduced John J. Carty, chairman of the Committee on Presentation, who spoke of the significance of the medal and its award. The next speaker was E. W. Rice, Jr., president of the General Electric Company, who told of the work of Dr. Thomson. He said that the latter had taken out about 700 United States patents, of which over 550 referred to electrical inventions. He spoke especially of Dr. Thomson's invention of the three-coil arc dynamo with its automatic regulator, the magnetic blowout, the modern transformer system with high-potential transmission and low-potential secondary distribution, the reactive coil, electric welding, the use of oil for insulating and cooling transformers, the constant-current transformer, the induction regulator, the single-phase repulsion motor, the high-frequency generator, the production of high-frequency currents from the direct-current arc, the watt-hour meter and the remote-control switch. Among mechanical inventions he referred to the centrifugal separator, the uniflow steam engine, the automobile muffler and miscellaneous work in optics and acoustics. As early as 1880 he performed wireless experiments similar to those later carried out by Hertz.

Richard C. Maclaurin, president of the Massachusetts Institute of Technology, also spoke of Dr. Thomson's work and the various aspects of his personality. The John Fritz medal was then presented to Elihu Thomson by Charles Warren Hunt and in response Dr. Thomson made a brief address in which he expressed his deep sense of appreciation of the honor.

INDEPENDENT TELEPHONE MEN DISCUSS THEIR PROBLEMS IN NATIONAL CONVENTION.

Annual Meeting of the United States Independent Telephone Association Held in Chicago.

The second annual convention of the United States Independent Telephone Association, which was formed by the consolidation of the two former national independent telephone associations a year ago, was held at the Hotel La-Salle in Chicago on December 5 to 8. The convention was well attended and devoted its time to the consideration of the many important problems before the independent telephone industry.

The first session opened with an address of welcome by Wm. R. Moss, of Chicago, to which Wm. Fortune, of Indianapolis, replied on behalf of the Association. President C. Y. McVey then read a brief presidential address, in which he called attention to two principal problems, namely, the extension of authority of the Interstate Commerce Commission to telephone companies, and the purchase by the Bell interests of noncompeting telephone companies. E. B. Fisher, chairman of the board of directors of the Association, made a brief address on the value of competition in the telephone industry.

F. B. MacKinnon, vice-president of the Association, presented a paper entitled "Our Association, Its Powers and Responsibilities," which dwelt on the strong position of the independent telephone industry and gave important financial and operating statistics showing this status. The greatly increased responsibility of the Association was emphasized and the need shown for more support in order that it can carry out its duties to the industry in matters of the greatest import. D. Stratton, of Winona, O., then spoke on "Applied Enthusiasm." Reports were presented by Vice-President MacKinnon and Secretary-Treasurer W. S. Vivian. L. E. Hurtz presented the report of the Committee on Outside Plant and F. V. Newman that of the Committee on Traffic, which has compiled a new book of operating rules.

On Wednesday morning there was a conference of officers of state associations at which matters of mutual interest were discussed and new officers of the conference elected. At the general session that afternoon the principal topic was transmission-line interferences. L. E. Hurtz, Lincoln, Nebr., presented a paper entitled "Interference with Telephone Service by High-Power Electric Transmission Lines." This paper dealt with the various phases of the subject at length and advocated that both parties study each other's problems. The subject was discussed by many of those present. H. L. Beyer, Grinnell, Iowa, then read a paper on "Legal Phases of Transmission-Line Interference." Numerous court decisions on this subject were cited; co-operation among the utilities was recommended. W. J. Canada, of the Bureau of Standards, Washington, D. C., presented a paper on "The National Electrical Safety Code as Affecting Telephone Practice." This paper reviewed the general scope of the new code and pointed out its particular bearing on the construction of overhead telephone lines.

On Thursday morning a traffic conference was held by those telephone men especially concerned with this branch of the business. The general session on Thursday afternoon considered a variety of matters. The result of the balloting on the new board of 31 directors was announced. A. A. Anderson, Evanston, Ill., presented a paper on "Modern Accounting." R. R. Stevens, Columbus, O., read a paper on "Getting the Business from the Viewpoint of the Larger Companies." Other papers presented were as follows: "Costs of Service," by George C. Mathews, Chicago, Ill.; "The New Advertising," by Roy D. Mock, Chicago; "Getting the Business in an Exchange of 3,000," by

P. M. Ferguson, Mankato, Minn. The annual banquet was held on the evening of December 7.

On Friday morning a meeting of the new board of directors of the Association was held at which all the officers were re-elected as follows: Chairman of the board, E. B. Fisher, Grand Rapids, Mich.; president, C. Y. McVey, Cleveland, O.; vice-presidents, W. H. Bryant, Mobile, Ala., G. W. Robinson, St. Paul, Minn., F. B. MacKinnon, Washington, D. C.; secretary-treasurer, W. S. Vivian, Chicago, Ill.

The concluding general session was held on Friday afternoon. The report of the Committee on Resolutions was presented by Mr. MacKinnon. The principal resolutions adopted provide for the following: (1) request the Interstate Commerce Commission to revise its definition of interstate carriers so as to exclude local telephone companies not engaged in long-distance interstate business; (2) petition to President Wilson and the attorney general of the United States to have the agreement of December 19, 1913, made by the American Telephone & Telegraph Company respecting interchange of toll-line service, carried out so as to provide this service without discrimination and on equitable terms; (3) opinion that valuations of telephone properties be based on actual cost, where records exist, or on cost of reproduction at average trend of prices; (4) urging that the American Telephone & Telegraph Company be required to divest itself of its control of the Western Electric Company, or to desist from manufacturing telephone apparatus through the Western Electric Company for sale in the competitive market; (5) requesting the board of directors to secure through enforcement of the anti-trust laws the prevention of the acquisition by the American Telephone & Telegraph Company, or its subsidiaries, of any independent non-competitive telephone properties; (6) reaffirmation of the Association's policy in favor of strict enforcement of anti-trust laws to prevent monopolizing of the telephone industry.

Frank G. Odell, Omaha, Neb., then presented a paper on "Rural Telephony in Europe and America"; J. M. Fitzgerald, Chicago, made an address on "Character Analysis of Your Man by a Practical Method"; the final paper was by S. Webb, of Shanghai, China, on the subject "The Dessicator and Its Uses," describing the use of dry-air pumps to remedy poor insulation in lead-covered cables.

As usual, a very complete exhibit was made by manufacturers of telephone apparatus and supplies. Among the exhibitors were the following: Electric Storage Battery Company; Fibre Conduit Company; Holtzer-Cabot Electric Company; Leeds & Northrup Company; Mathias Klein & Sons; McMeen & Miller, Incorporated; Naugle Pole & Tie Company; Nungesser Carbon & Battery Works; Page & Hill Company; John A. Roebling's Sons Company; Standard Underground Cable Company; Torrey Cedar Company; Utilities Indemnity Exchange.

Linking Science and Art With Practice in Lighting.

The foregoing was the title of an address made by M. Luckiesh, of Cleveland, O., at the December 8 meeting of the Chicago Section of the Illuminating Engineering Society. Mr. Luckiesh showed that the real developments of the lighting industry, corresponding with the establishment of the Illuminating Engineering Society, are but ten years old. It was not to be wondered at, therefore, that the scientific and efficiency features of lighting problems have been strongly emphasized by illuminating engineers and the esthetic features almost entirely neglected. There is urgent need of training the illuminating engineer into a real lighting expert who will take into consideration every element of each problem undertaken. At the present time Mr. Luckiesh thought that there were barely a dozen true lighting experts in the country, which was one of the reasons why the architect has not taken kindly to the usually restricted aims of the illuminating engineer.

In attacking a problem, the illuminating engineer too frequently attempts a short cut, involving merely a few computations before the installation is made. A real lighting expert, according to Mr. Luckiesh's conception, would undertake the problem in some seven steps, as follows: consultation, visualization, computation, contemplation, experimentation, installation, and finally realization. In following this order more or less closely consideration would be given to the aims of the architect and a plan developed, tried out and finally installed that would be in full harmony with all the conditions and requirements involved.

The illuminating engineer very generally concerns himself only with a good location of lighting outlets and forgets to consider actual lighting effects. Factors that are commonly neglected, even in commercial and industrial installations, are background, decoration, safety requirements, brightness differences and contrast effects.

Mr. Luckiesh thinks that we are usually working under too low illumination intensities at night, in fact, exceptionally low by contrast with daylight. The tables of intensities frequently given for various purposes should be designated as minimum allowable values, instead of as correct or recommended practice.

The value of beauty was briefly touched on and some of the possibilities of attaining it in a lighting installation pointed out. Symmetery is often overemphasized and contrast effects not used enough. Beauty can be harmonized with utility. Many fixtures now available are designed with only one of these considerations in mind. Mr. Luckiesh believes that the fixtures of the future will provide for the possibility of getting a variety of lighting effects by merely switching and thus relieve the monotony that is so noticeable in many homes. It should be remembered that light, on account of the possibility of readily changing its two elements (brightness and color), is the greatest medium for artistic treatment available.

The subject was further discussed by O. R. Hogue and M. G. Lloyd. Mr. Luckiesh, in conclusion, said he believed that some of the most important developments in light sources of the future will be with the idea of making the lamp a finished product as by producing economically bulbs of different tints, say, amber, pink, etc.

Recommendation for Seattle to Abandon Plans for Waterpower Development.

That the city of Seattle, Wash., should abandon plans for the development of the Sauk-Suiattle power site on government land near the town of Darrington is being advocated by City Engineer A. H. Dimock. The recommendation followed the receipt by Mr. Dimock of a letter from the forest ranger at Portland, asking the city to immediately advise him as to its intention relative to this project. It was about a year ago that the city made application for water rights, following it with some investigations. Engineer Dimock estimates that at least $50,000 will be required to make the necessary investigations before the city should obligate itself to develop the project. Councilman R. H. Thomson, former city engineer, and who has made an examination of the project, holds a like opinion.

The American Nitrogen Products Company has expended about $25,000 in investigating this project and asserts that it has the finances for the immediate development, with a view to an ultimate investment of $25,000,000 in a plant for the manufacture of nitrogen products. It is understood that if the city steps aside this company will obtain full rights. Members of the Council are reluctant to abandon the plan for development of the project.

LOUISVILLE ELECTRICAL EXPOSITION BIG SUCCESS.

Over 85,000 Persons Attended Show Which Celebrated America's Electrical Week.

The electrical exposition at Louisville, conducted by the local Jovians in celebration of America's Electrical Week, was a highly successful venture. Conservative estimates place the number who attended the exhibition and inspected the exhibits at more than 85,000. Altogether nearly 300 concerns in the electrical and allied fields were represented in the exhibits, which included everything imaginable electrically from a cigar lighter to the running gear of a modern street car. An estimate of the value of the items shown placed them at approximately half a million dollars.

A Photograph Taken on December 2 by M. Rosenfeld Showing Flood Lighting of Statue of Liberty.

The show was held in the Jefferson County Armory, which has one of the largest drill halls in the country. In the center was erected an ornate bandstand with a space reserved for dancing around it. Automobile displays were grouped in the central part of the floor and the booths of the exhibitors were ranged around the walls under the balconies. Most of the local dealers in fixtures, appliances, supplies, etc., were represented, as were the contractors. The Louisville Railway Company displayed the equipment of one of the large new cars, contrasting it with the equipment common to the cars which the company operated in Louisville in 1890.

In the two booths of the Louisville Gas & Electric Company there was much interest taken, one of them having been designed to show just about all the faulty kinds of wiring and installation that is possible and the adjoining booth being prepared to represent the highest types of electric lighting installation. Many of the complaints which are made to the company's representatives are against the rigid inspection in vogue at this time. So the exhibit was arranged to give a graphic picture of the methods and manner of wiring in use before inspection was the rule. It was explained by the attendant that practically all the fires which can be justly charged to electric wires are due to old installations partaking more or less of the nature of this one.

Added interest was given to this display by the old generator in operation in the center of the room, arranged as a stage setting, with painted drops to form the rear and side walls. This generator was originally operated in Louisville, having been taken there to furnish the incandescent lighting for the Great Southern Exposition held in 1884. It is a hundred-light generator and, after the exposition, was acquired by the Courier-Journal Company and for some years provided the current for commercial arc lights served by that company's isolated plant. The old machine was in good condition, with the original windings, etc., and needed only to be belted to a five-horsepower motor concealed behind the wall, to give just about as good light and service as it ever did.

Robert Montgomery, as chairman of the Executive Committee of the Louisville Jovian League, was most active in making ready and in directing the exposition. With him President Frank H. Miller, superintendent of motive power of the Louisville Railway Company, worked loyally, as did Paul Tafel, secretary and designer of one of the best of the dealer displays in the show.

The Louisville show was organized on a basis by which its financial success was practically assured before the doors were opened. A ten-cent admission fee was charged, although exhibitors distributed many tickets. To make the attraction draw better a first-class band was provided and in constant operation, for dancing, etc., and afternoon and evening programs were given by a troupe of aerial gymnasts. The Armory was elaborately decorated.

General View of Louisville Show.

One of the Historic Exhibits.

Miscellaneous NEWS NOTES

Board of Governors, Electrical Supply Manufacturers, to Meet.—The regular meeting of the board of governors of the Associated Manufacturers of Electrical Supplies will be held at the offices of the association, 62 Cedar Street, New York City, on December 20 at 2:30 p. m.

Shortest Electric Railway Line.—The Central Illinois Public Service Company is constructing the shortest electric railway line in the United States. It runs from a coal mine to the company's electric power plant at Kincaid, Ill., a distance of only one-quarter of a mile. The line will cut the cost of hauling the coal for the plant. Heretofore the company paid $12 a load for hauling and $2 for unloading each car. It is estimated a big saving can be made.

Shortage of Fuel Argument for Annexation of Suburb to City.—The city of Norwood, O., which is included within the corporate limits of Cincinnati, O., but refuses annexation, has been compelled to run its electric plant on a short-time schedule, on account of the inability to secure an adequate supply of fuel for the operation of the plant. This has furnished another argument to those favoring annexation to Cincinnati, whose residents receive service from the Union Gas & Electric Company, which has had no trouble on the score of its fuel supply.

New York Section Illuminating Engineering Society Meeting.—On December 14 the New York Section of the Illuminating Engineering Society held a very enthusiastic meeting at which two very interesting papers were presented. One entitled "Lighting Liberty," was presented by H. H. Madgsick, who was responsible for the illuminating engineering work in connection with this installation. The other paper was entitled "What the Theater Expects from the Illuminating Engineer," by T. C. Browne. In connection with the paper on the lighting of the Statue of Liberty, an inspection trip was made to the statue in the afternoon.

Connecticut Central Station to Build Large Plant.—It is announced that the United Electric Light & Power Company, Waterbury, Conn., will construct a $1,000,000 station in the town of Devon, to supply the Naugatuck valley. An important reason for the building of the new plant is that coal supplies by car to the station in Waterbury are uncertain and subject to delay; hence the establishment of this new station at tide water, in territory served by the United Illuminating Company of New Haven and Bridgeport. The river banks at Devon will be developed for dockage and large coal pockets, and the plant will be the nucleus for a busy industrial center. The territorial rights of the United Illuminating Company will not be invaded.

Mr. Insull Talks Before Chicago Electrical Men.—At the meeting held on December 7 by the Electric Club-Jovian League of Chicago, Samuel Insull, president of the Commonwealth Edison Company, Chicago, spoke on the significance of America's Electrical Week and the possibilities ahead of the industry. Citing numerous personal reminiscences, he called attention to the extraordinary strides made in the electrical business, particularly the central-station field, which is barely 35 years old. Credit for the inauguration of the movement for intensive electrical new-business development and for the conception of an annual electrical week he gave to Henry L. Doherty, president of the Society for Electrical Development and Jupiter of the Jovian Order. The success of these aggressive commercial movements is giving the industry a wonderful impetus. Remarkable as have been the achievements up to the present, it is probable that still more remarkable achievements are in store. For example, the electrification of railroad mountain divisions, terminals, and even of trunk lines where there is great density of traffic, is one of the things that is bound to come.

Aluminum Plant for Baltimore.—Announcement has been made that the Aluminum Ore Company, a branch of the Aluminum Company of America, has purchased a site at Sollers Point, near Baltimore, Md., and will erect a $2,000,000 plant for the treatment of raw material for the manufacture of aluminum, which will be carried out at the Aluminum Company's plants.

Unique Rate Case Before Illinois Commission.—The Illinois Public Utilities Commission is considering a case presented by the East St. Louis Light & Power Company against the proprietor of a motion-picture theater in East St. Louis. The latter has installed a motor-generator set and purchases energy for its operation on the power schedule, but uses the energy generated for lighting the theater. The company contends rates for commercial lighting should be charged, and the commission has taken the case under advisement. A similar case before the New York Commission some time ago was decided in favor of the consumer.

Brooklyn Edison Company Applies for Rehearing on Rate Case.—The Edison Electric Illuminating Company of Brooklyn, which was ordered by the Public Service Commission for the First District of New York on October 27 to reduce its maximum rates for electrical energy from 11 cents to 8 cents per kilowatt-hour, has declined to accept the order of the commission and has applied for a rehearing. The company through counsel filed a petition stating 16 points in which the company differs from the commission's findings. The reductions made by the commission for depreciation, failure to include various amounts in fixing the valuation of the company's property and the making of rates are described as unjust, unreasonable and discriminatory.

Commission to Investigate Electric Rates of New York Company.—The Public Service Commission for the First District of New York has decided to investigate the rates charged for electrical energy by the Queens Borough Gas & Electric Company, which serves the Rockaways section of Queens. The investigation is undertaken in the effort to see if it may be possible to secure reductions for consumers. The company has a maximum rate of 13 cents per kilowatt-hour, and furnishes both electricity and gas to residents of the section mentioned as well as for other communities adjoining New York. The pending investigation, however, has only to do with the electric rate in the localities served by the company within the city of New York, which is as far as the jurisdiction of the Public Service Commission for the First District of New York extends.

Properties of Public Service Electric Company Valued at $44,386,000.—In connection with the investigations being made by the Board of Public Utility Commissioners of New Jersey to determine the reasonableness of the existing rates of service of the Public Service Electric Company, Dr. D. C. Jackson, of Boston, engaged as a valuation expert by the board, has submitted a supplementary report, at a hearing November 23, setting forth an estimation of cost of reproducing the present underground lines and certain other properties of the company at $9,624,606. In the first report presented by Dr. Jackson in January, 1916, the cost of reproduction of the company's overhead lines, power and substations and buildings, was placed at $35,008,200. Combining the two reports, with certain revisions explained at the hearing by Dr. Jackson, it is shown that the physical valuation of the company's property from an engineering viewpoint is $44,386,000. This figure allows 3 per cent for contractors' profits in construction, and an allowance of about $300,000 for construction handled individually by the company. Attention is called to the fact that the report does not include so-called intangible property. The next hearing of the commission has been called for December 13.

Explanation of the Phase Converter

A Discussion of the Theory and Applications of the Phase Converter Taken from a Paper Presented at the Philadelphia Meeting of the American Institute of Electrical Engineers

By E. F. W. ALEXANDERSON and G. H. HILL

THE earliest known form of phase conversion is splitting the phase by inductance and capacity. In this case the energy of one phase is stored for a fraction of a cycle and released again so as to make the same energy active in another phase. All methods of phase conversion, therefor, involve the storage of energy. Even the phase conversion, so called, of wattless currents necessarily involves storage of energy. The expression "wattless energy" is not such a contradiction as it has sometimes been claimed to be. When energy is wattless it means that the energy delivered during one portion of a half cycle is returned during the other portion of the same half cycle; therefore the average energy flow is zero. But at the same time, we must not forget that even if a current is completely wattless, there is a real energy flow in both directions. Thus if we wish to change the phase of the current, whether energy current or wattless current, we must provide means for storing the momentary energy flow for a time corresponding to the change of phase that is to be effected.

The method of storing energy in inductances and condensers is very convenient for high-frequency currents but has not up to the present found much practical application for low-frequency power current. There is, therefore, for phase conversion on a large scale, only one type of apparatus that can be considered—a rotating machine which stores the energy in the mechanical inertia of the rotor.

In order to arrive at an understanding of the physical functions of phase conversion with a rotating machine, several different points of view are possible, as sometimes one and sometimes another is more helpful in arriving at direct conclusions. The following three methods of looking at the problem may be helpful.

Phase Converter Considered as a Motor-Generator.

The phase converter is built as a quarter-phase induction motor or synchronous motor with a squirrel cage; one phase is a motor phase and the other phase is a generator phase. The input of the motor phase is equal to the output from the generator phase, not only in the average value of the power flow but in the instantaneous value of energy flow which is delivered and returned during the same half cycle. The only difference between the energy flow in the two phase windings of the converter is that the momentary values of current, volts and energy are delayed one-quarter cycle in one winding in relation to the other. The squirrel cage is the medium for the transfer of energy, and the mechanical mass of the rotor provides the energy storage. In order to make it possible to store the energy in the rotor, there must be corresponding changes of speed and therefore the rotor must go through a cycle of speed change during each half cycle of the alternating-current flow. This speed change of the rotor is evidenced by the vibration which is a characteristic of any single-phase machine. The speed change of the rotor has, however, nothing to do with the electrical functions of the machine in performing as a phase converter. If we could couple the rotor to a flywheel of infinite weight so that the speed change would be zero, the converter would perform in the same way.

Having thus explained how it is conceivable that the phase converter operates as a motor-generator, it remains to explain what means are provided for making it perform in this way; in other words, what causes the energy flow in the two phases to vary the same cycle of momentary values although delayed one-quarter cycle in time. Various means can be provided for producing the desired energy flow and will lead to different types of phase converters. Broadly, it can be stated that whatever means are provided, the result of these means must be the desired flow of currents through the windings, and therefore the means must consist in providing the necessary electromotive forces to cause these currents to flow through the windings.

One method of providing these electromotive forces is to use an auxiliary generator which impresses the desired electromotive force on the windings. Instead of a generator any other convenient source of electromotive force may be used, such as a transformer or an induction regulator. Another method is to connect the windings of the converter, with reference to the source of power and the load, in such a way that the electromotive forces are furnished automatically by the source of power.

The first method leads to the phase converter connected in shunt to the line and is the type that has been adopted in the phase balancer sets of the Philadelphia Electric Company; for the sake of brevity this type may be referred to as the shunt converter. The function of the shunt converter is to transfer energy from one phase to another in a polyphase system so as to neutralize the effect of single-phase load drawn from the same system in another place. The second method of producing the desired flow of current in the system leads to the series converter. In this type of converter the single-phase circuit is in series with one phase of the converter. This arrangement is well adapted for change of polyphase to single-phase power and this method is in some cases preferable to the shunt converter. The function of the series converter is not to correct for a single-phase load that has been placed on a polyphase line but to change the single-phase load into a polyphase load before it is connected to the line.

The Phase Converter Considered as a Polyphase Generator.

This second point of view is more artificial than the first but is more helpful in analyzing the function of the phase converter. For the purpose of such analyzing, a well known mathematical artifice is made use of. A single-phase current can be considered as resolved into two polyphase components with opposite phase rotation. One of these polyphase components has the same phase rotation as a power system and constitutes a legitimate load on the power system. The other component, which has the opposite phase rotation, is the one that causes the unbalancing of voltage, heating of generators and motors connected to the system, etc. The function of the phase converter is to neutralize this component of the single-phase load which has opposite phase rotation. From these considerations, it becomes evident how the phase balancing can be accomplished. This function consists in providing a machine which feeds into the system a polyphase current which has opposite phase rotation to the system, and is equal and opposite to the component of the single-phase load we wish to neutralize. It is now evident how the phase balancer ought to be constructed. The converter should be a polyphase machine, not necessarily synchronous, but preferably so in order not to draw lagging current from the system, and means are to be provided for forcing a current to flow through the windings of the phase machine which has opposite phase rotation to the system. The currents of opposite phase rotation are to be regulated in magnitude and

phase corresponding to the single-phase load. One convenient way of producing such adjustable polyphase currents is to provide a polyphase generator with its field controlled by suitable regulators. These considerations lead to the design of the shunt converter with direct-connected balancer and regulators such as used by the Philadelphia Electric Company. The sets consist of a main converter and an auxiliary balancing machine which is controlled by automatic regulators. The main converter is mechanically connected to a generator which is called a balancer. The function of this balancer is to circulate polyphase currents of the desired phase and magnitude in the windings of the converter. This auxiliary generator is small compared to the converter because its output is used only to overcome the losses and inductive drop in the windings of the main converter.

The Phase Converter Considered as a Transformer.

This point of view is also more artificial than the first one but it is helpful in understanding and analyzing the functions of the series converter. The two stator windings of the phase converter are considered as the primary and secondary of a transformer. The squirrel-cage rotor is a medium for transferring the current from the primary to the secondary and the characteristic of the phase converter as a transformer differs from the ordinary transformer only by the fact that the time phase of the secondary is one-quarter cycle from the time phase of the primary. This displacement of time phase is due to the time required for the squirrel cage to rotate through the angle corresponding to the location of the primary and secondary windings of the stator.

The function of the series converter is most easily explained in connection with a quarter-phase system, but it is obvious that it can be used in a three-phase system by the use of a Scott transformer connection. The object in the use of the converter is to distribute the single-phase load equally in the two phases of the quarter-phase system. If the problem were to distribute the single-phase load in two circuits of a single-phase system, it is easy to see how this could be done by the use of a series transformer. The single-phase load might be put directly in series with one circuit through the intermediary of a series transformer. If this transformer has a ratio of 1:1, the current would be equally distributed on the two circuits at all loads. The two phases of the quarter-phase system differ from the two circuits of the single-phase system for our present purpose only by the relative time phase. However, if the phase converter may be used as a transformer which changes the time phase of the current between its primary and its secondary to the desired degree, it can be used as a series transformer between the single-phase load circuit and one of the phases of the quarter-phase system in the same way and with the same characteristics as stated above with reference to the ordinary series transformer used to distribute the load on two circuits of the single-phase system. Carrying the analogy between the phase converter and the transformer still further, we can trace the source of the electromotive force required to force equal and opposite currents to flow in the primary and secondary windings. This electromotive force is derived directly from the primary circuit. To cause a current to flow through a winding requires a voltage and this voltage is evidenced by the impedance drop in the winding. From the theory of transformation, we have become in the habit of regarding the impedance of the primary and secondary windings of a transformer as a single impedance, which for the sake of convenience can be said to be located in either the secondary or primary windings. In either case we assume that a certain amount of the primary voltage is used up to overcome the impedance drop of the transformer windings. This impedance drop is evidenced by the voltage drop on the terminals of the secondary winding. The same considerations apply to the use of the converter as a series transformer. The ratio of current transformation is for all practical purposes constant at all loads at which the transformer can be used. The voltage drop on the secondary side is the sum of the impedance drop in the primary and secondary winding. In the case of the phase converter, the impedance drop includes the drop in the squirrel cage which is the transfer medium. However, we are also in the habit of measuring the impedance of the induction motor windings on the primary side and look upon the impedance in the stator and the rotor as concentrated in the stator winding. We therefore find that the impedance of a converter when considered as a transformer is the same as the stationary impedance of the same machine measured as an induction motor at standstill. From this analog, we have a right to expect the following characteristics of the series converter and these conclusions are in entire agreement with practical measurements. The change of a single-phase load into polyphase load is automatic and results in a *perfect distribution of current in the two phases at all loads.* The voltage delivered to the single-phase circuit has a slight drop with increasing load and has the same characteristics with reference to current and power-factor that would be obtained by placing an impedance in series with the single-phase circuit equal to the impedance of the windings of the converter.

Applications of Phase Converter.

In regard to efficiency and size, the phase converter can be considered as being in the same class as the synchronous condenser. In fact it has substantially the same structure, the difference being that the squirrel cage which is usually employed in the synchronous condenser to counteract hunting becomes in the phase converter the main rotor winding, while the field winding of the synchronous condenser is reduced to a small winding sufficient to carry no-load excitation. Due to the similarity in structure the same machine can act as a synchronous condenser and phase converter at the same time if the windings are proportioned for this purpose. The fact that the machines can be designed so that they are useful as synchronous condensers and phase converters simultaneously is worth consideration in the application of the methods of phase conversion, as several methods of application are possible. In the first place, it is possible to place the phase converter either in the power house or at any desired place in the distribution system. Synchronous condensers may be needed on distribution systems for the sake of counteracting low power-factor, and such synchronous condensers can, if desired, be designed so that they can in addition be used as phase balancers, in order to make it possible to draw single-phase load from the same system. If, on the other hand, the main load is synchronous converters with unity or leading power-factor, it may be more practical to locate the phase balancers in the power stations. The single-phase load is usually of low power-factor and the lagging current of the single-phase system may be furnished either to the single-phase distribution system by single-phase synchronous condensers or may be furnished in the power house by polyphase machinery after the whole kilovolt-amperes of the single-phase load has been converted to polyphase. In the latter case, the phase converter can be used for power-factor correction as well as phase conversion, but in that case it must be large enough to convert the whole single-phase kilovolt-amperes at a low power-factor and then furnish polyphase current to correct for this power-factor; whereas in the other case where the single-phase power-factor is corrected for by synchronous condensers the phase converter needs to convert only the power component of the single-phase load. The choice between these methods of conversion will depend upon local conditions of expediency.

The shunt converter is of particular value in those cases

when it is expected that single-phase load may be drawn from different phases of a polyphase system. In such cases unbalancing of the single-phase load will be partly neutralized and it will be necessary to convert only the difference between the single-phase loads. There are, on the other hand, cases where the series phase converter can be used to best advantage. Those are cases when it is desired to convert the single-phase load at the point where it is connected to the polyphase system. The series converter has in that case the advantage of simplicity, as the arrangement is automatic and no auxiliary generator or voltage regulator is needed. In cases where a single electric-welding machine or arc furnace is to be fed from a polyphase system, the series converter should be recommended. If such an installation has been made with a series converter in order to insure the lowest first cost and it should be desired to add other furnaces to the other phases, the same converter might be used as a shunt converter without any increase of converter capacity but with the addition of suitable regulating devices.

It has been pointed out that a synchronous condenser has a structure suitable for phase conversion. The same is the case with an induction motor or a single-phase turbogenerator, in fact any polyphase machine with a squirrel cage. Such machines are always connected in shunt to the line and would, therefore, be available as shunt converters wherever desired. If, for instance, a power house is built primarily for furnishing single-phase power from single-phase generators but it is desired to furnish a certain amount of polyphase power in addition, the objection arises that the polyphase voltage is unbalanced in proportion to the single-phase load. In such a case it might be expedient to use the squirrel cage of the turbogenerator as a converter medium by adding suitable regulating devices. The interchange of current between the phases is then already determined by the load conditions, but the electromotive forces necessary to cause this interchange of current appear in the unbalancing of the line voltage. This unbalancing of voltages can be treated with the same method of analysis as given in the preceding for the unbalancing of current. The unbalancing electromotive forces are resolved into their components and the correcting electromotive force may be furnished by a generator driven either from the turbine shaft or by a synchronous motor. This generator has the same character and functions as the auxiliary balancing generator in the phase-converter set. A power house for mixed single-phase and polyphase load equipped in this way can be operated in multiple with other power houses using standard polyphase generators.

Workmen's Compensation Insurance Considered at Kentucky Association Convention.

At a convention of the Kentucky Association of Public Utilities, held last week in Louisville, Robert T. Caldwell and other members of the Kentucky Workmen's Compensation Board, spoke on workmen's compensation insurance, and the meeting was given over in large part to this subject. J. A. Brett, of the Westinghouse Electric & Manufacturing Company, spoke on "Relations Between Utility Men and Manufacturers;" W. W. Freeman, of the Union Gas & Electric Company, Cincinnati, O., spoke on "Franchises," and H. Wurdack, of the Light & Development Company, St. Louis, Mo., who is also president of the Missouri Public Utilities Association, discussed "Maintenance and Depreciation."

Harry Reed, of the Kentucky Utilities Company, Louisville, was elected president of the association, the other officers elected being: Philip S. Pogue, of the Louisville Home Telephone Company, first vice-president; W. L. Weston, of the Paducah Light & Traction Company, second vice-president, and J. B. Riley, of Louisville, re-elected secretary-treasurer.

Telephone Used to Call Delegates to a National Convention.

The telephone was used extensively to call attention to and to stimulate interest in the Central States Conference on Rail and Water Transportation in Evansville, Ind., December 14 and 15.

At the solicitation of the leaders of the conference, the Chicago Telephone Company and other telephone companies in the Bell System co-operated, and notified 770 persons of the conference by telephone.

Between the hours of 9 a. m. and 12 m. on December 7, the Chicago company called up 528 persons within the city and delivered the message regarding the meeting. The same message was delivered by telephone to 72 persons in Joliet; 60 in Aurora; 60 in Elgin; and 50 in Waukegan.

In addition, the same message was sent out from Bell exchanges in 238 other cities.

The persons called by telephone displayed much interest, not only in the conference, but also in the spirit of co-operation shown by the telephone company in helping to arouse interest in the conference.

The purpose of the conference is to bring together representative business men of the central western states to discuss the vital questions of railway and water transportation, and hear each phase of these questions now uppermost in the public mind, presented by men of authority.

N. C. Kingsbury, vice-president of the American Telephone & Telegraph Company, is one of the speakers at the conference.

Unique Traffic Post Used in Modesto.

The accompanying illustration shows a "Traffic Guide Post" as adopted by the City of Modesto, Cal., and is unique in design, being in the form of a vase surmounted by a receptacle holding ferns, etc.

In the square below, and showing four ways through red "bull's eyes" is a 40-watt, incandescent lamp connected underground from the city's series street-lighting circuit through a 0.04-kilowatt transformer mounted on top of the fixture on the corner.

These posts are made of reinforced concrete and weigh about

Artistic Traffic Post Used in Modesto, Cal.—A 40-Watt Lamp Is Installed in Each Post.

400 pounds; they were designed and built by the city elec- W. I. Carpenter, at the suggestion of Commissioner of Public Health and Safety C. D. Swan

The posts are connected in such a way that if struck or moved the connection is automatically broken, leaving the exposed contacts attached to the post.

Motor Drive of Hydraulic-Elevator Pumps

Comprehensive Data on the Use of Central-Station Service for Operating Elevator Pumps in Important Chicago Buildings—Value of Business to Central Stations Shown

By CHARLES J. CARLSEN

Industrial Power Series—Article No. 185

FOR many years, in fact until a very short time ago, the hydraulic elevator with its steam-driven auxiliaries presented the most formidable obstacle to the substitution of central-station service for isolated-plant generation. Today that obstacle has been overcome and to the mutual advantage of both central-station interests and isolated-plant management.

It is not the intention to go into the merits or demerits of the various types of elevators. The steam elevator is a thing of the past, it having served its purpose, leaving the field open to the two great types of equipment, hydraulic and electric. Both have good, sound and logical reasons for their existence and with which the central-station man need not concern himself, his position being one of absolute neutrality, as he can serve either to advantage.

It would be unreasonable to expect one test or the operation of one plant to prove conclusively the great advantage of central-station service in the operation of hydraulic elevators, yet in the present instance the records and operation of the plant presented are so clear, complete and conclusive as to bear the closest inspection and study by both central-station and isolated-plant interests.

In a measure, the dual operation of a hydraulic-elevator system operating on steam during the winter months and taking advantage of the exhaust steam for heating purposes, and operating electrically during the summer months, presents a problem with great possibilities as to plant economy and are well worthy of study from every angle. The problem presented herewith is such a one.

Data on Chicago Department Store.

The records and data herewith are from Hillman's Department Store, Chicago, Ill., and cover a period of three years, the records for 1916 not having been compiled as yet.

In order to make the data as clear as possible, so that those who desire may make a careful study of the problem, the records begin on the last year of the building operation from their own power plant, 1910. In March, 1911, central-station service was installed and has been in use ever since.

The building was provided with 13 elevators, nine being hydraulic passenger elevators, four being installed in one bank

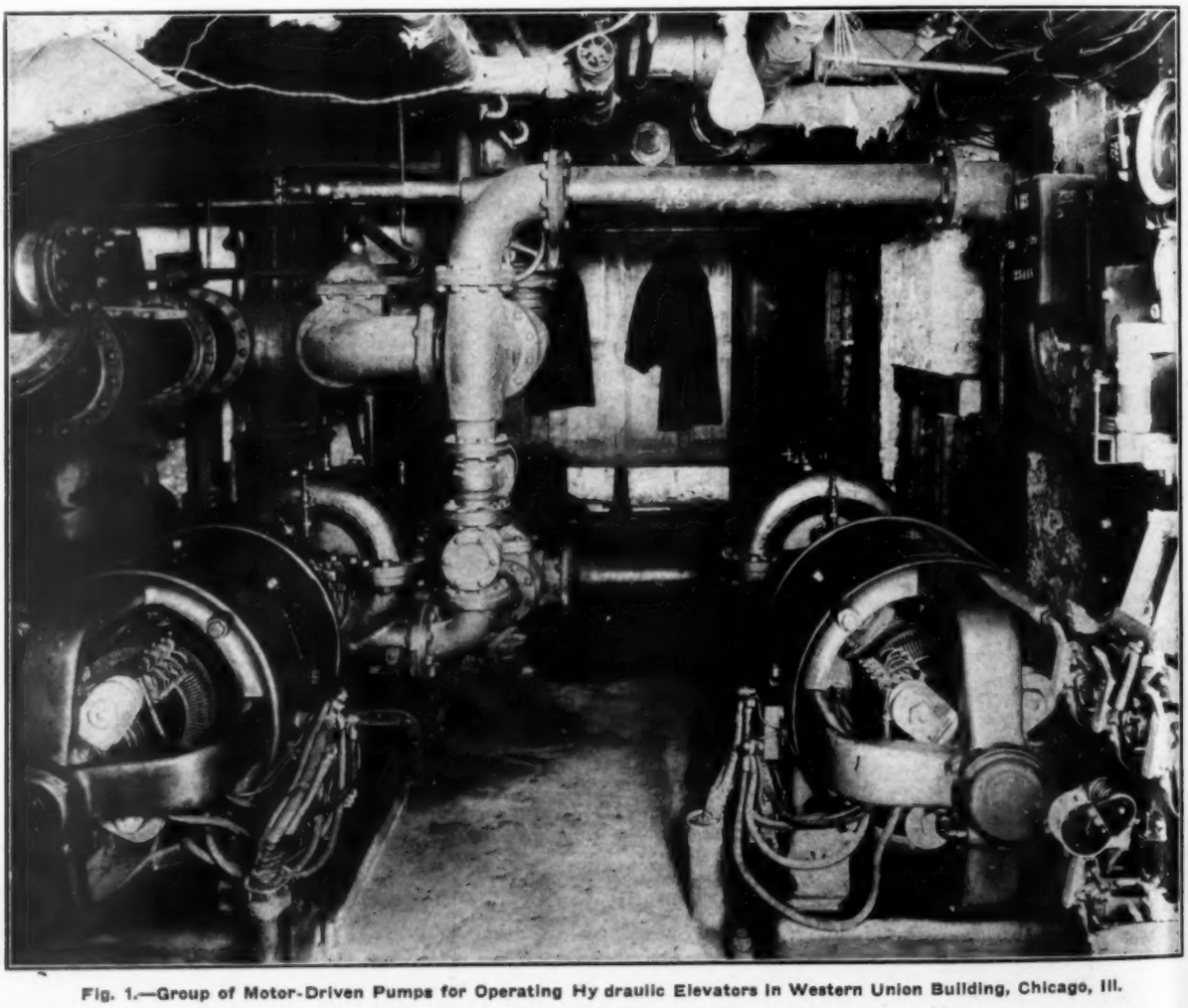


Fig. 1.—Group of Motor-Driven Pumps for Operating Hydraulic Elevators in Western Union Building, Chicago, Ill.

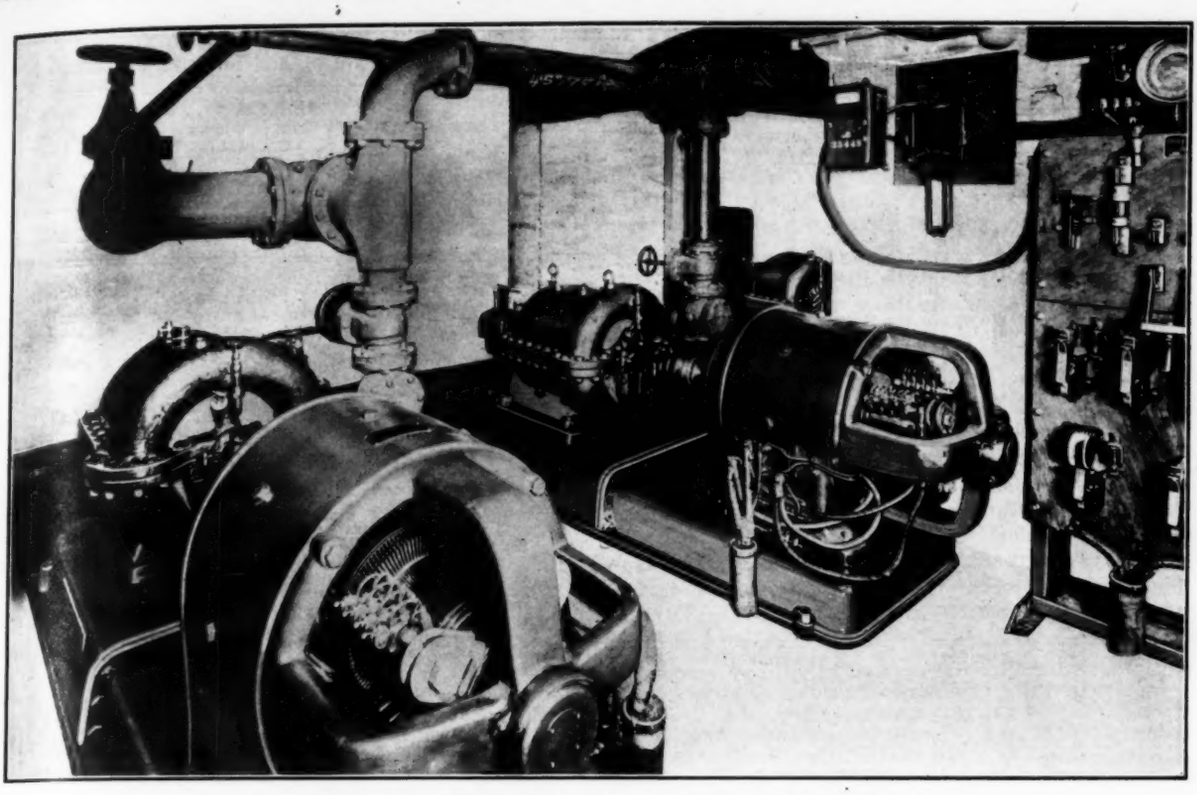


Fig. 2.—Motor-Driven Pumps in Western Union Building, Chicago.

and five in another, and four steam elevators, two of them for passenger service and two for freight.

The hydraulic elevators were provided each with vertical cylinders and plunger equipment 13 inches in diameter and 30 feet long with a maximum lift of about 80 feet and a speed of about 400 feet per minute. Cages will accommodate from 14 to 16 persons. Cars operate on about one-half minute schedule. Maximum pressure on the hydraulic system is 160 pounds.

The steam equipment used for operating these elevators was a 14-by-22-inch, 14-by-20-inch Burnham simplex compound pump; a 14-by-20-inch, 9-by-18-inch duplex compound pump and a 16-by-9-by-18-inch duplex simple pump. On test these combined pumps, as operated, consumed from 120 to 160 pounds of steam per indicated horsepower-hour.

Electrical Equipment for Hydraulic Elevators.

A recommendation was made covering the installation of electrically operated pumps for summer operation of the hydraulic elevators, with a suggestion that elevators be operated from the steam pumps during the winter months, and advantage taken of the exhaust steam for building heating purposes.

This recommendation was accepted and three three-stage, 400-gallon-per-minute Alberger turbine pumps, each direct-connected, on common subbase, to a 55-horsepower, 1750-revolutions-per-minute, 230-volt direct-current motor were installed. Each unit is controlled by a Cutler-Hammer automatic control panel.

One pump is set at 160 pounds pressure, a second at 153 pounds and a third at 145 pounds, and their order of operation is rotated every two weeks, so that each pump will be in operation two weeks, practically shut down two weeks and on emergency or auxiliary service two weeks, thereby giving uniform wear to each unit. This is accomplished by simply shifting the gage control every two weeks for each unit.

Low Maintenance Cost.

This equipment has now completed its fourth year of service and the total maintenance expense for this entire period has been less than $50, the only expense to date being for brushes and necessary labor for storing commutators. The entire cost of the equipment completely installed was $5,400, the work of installation being performed by the chief engineer and his men.

Motor-pump installation was started May 16, 1913. Of the four steam elevators, the two passenger elevators were retained on steam operation. One of the freight elevators was changed to electric and used for regular service, the other freight elevator being retained as steam-operated and used for emergency purposes only.

In April, 1913, additional space was acquired in an adjoining building and in July of the same year a large electric sign was installed, both of which aid in increasing the kilowatt-hour consumption, as will be noticed in the table.

In September, 1913, a contract was entered into for supplying steam to the adjacent building for the operation of elevator pumps operating four hydraulic elevators, a house pump, an air pump for Schare ejector vacuum cleaner, hot water and building heating, and this in amount reached about 25 million pounds of steam per year as measured by a St. Johns meter.

The contract agreement was for $500 per month. All condensation, excepting hot-water requirements, is wasted to the sewer, there being no means provided for delivering these returns to the hot well of boiler plant. For the reasons as set forth the central-station side of the accounting is entitled to credit the equivalent of steam sold and water purchased as supplied to the adjacent building. In the spring of 1915 steam baths were installed in this adjacent building which called for an increased steam consumption of nearly 50 per cent during the summer months.

In analyzing the following data it is absolutely essential that the preceding notes and explanation be clearly understood as they have a direct bearing on the results obtained.

In Table I a noteworthy feature is the marked increase

in maximum load and kilowatt-hour consumption, due to elevator load, beginning in May and dropping off in October.

TABLE NO. 1. MAXIMUM LOAD AND KILOWATT-HOUR CONSUMPTION BY MONTHS.

	1911		1912		1913		1914		1915	
Month	Max.	Kwh.	Max.	Kwh.	Max.	Kwh.	Max.	Kwh.	Max.	Kwh.
January	.....	.....	263	69,845	276	104,170	393	111,215	349	104,430
February	.....	.....	243	69,710	312	86,430	411	102,475	328	101,000
March	313	34,825	233	70,910	272	91,190	368	118,655	312	104,010
April	273	71,130	250	71,310	318	92,108	363	119,685	325	105,945
May	255	79,785	253	72,040	388	119,370	437	134,650	403	123,850
June	245	66,405	260	69,520	404	123,335	430	177,555	405	133,205
July	243	67,375	257	72,190	404	134,630	421	154,695	408	148,595
August	227	66,930	247	70,755	412	141,260	408	143,755	399	137,130
September	223	68,320	257	70,840	413	138,470	428	145,565	407	134,420
October	240	67,175	252	72,355	434	132,635	428	139,115	387	118,675
November	275	73,510	269	75,495	374	111,195	342	111,805	344	104,405
December	283	77,900	368	88,685	382	124,225	346	114,095	315	112,220

In Table 2, car-miles were obtained by trip counters installed on each elevator. The kilowatt-hour consumption per car-mile for this particular class of service and elevator was about 12.5 kilowatt-hours. The average kilowatt-hours per car-mile for an electric elevator in department store service was 9.

TABLE NO. 2. METER READINGS IN KILOWATT-HOURS ON ELECTRICALLY OPERATED ELEVATOR PUMPS. STARTED MAY 16, 1913.

	Meter Number			
	38,835	30,670	31,246	Totals
May 31	1,790	1,020	1,850	4,660
June 30	8,730	4,660	9,000	22,390
July 31	10,500	3,590	10,030	24,120
August 30	13,000	3,030	9,150	25,180
September 30	13,040	1,550	9,820	24,410
October 30	11,320	1,190	9,750	22,260
November 29	110	50	50	210
December 31	0	0	0	0
Total Kilowatt-hours—123,230.	Car-miles—10,295.			
January 31, 1914	0	0	0	0
February	0	0	0	0
March 2	610	1,230	960	2,800
April 2	850	30	0	880
April 30	4,500	1,160	0	5,660
May 7	7,990	1,750	330	10,070
May 29	7,920	6,230	5,440	19,590
June 30	9,610	8,970	6,610	25,190
July 31	4,970	8,880	10,720	24,570
August 31	10,210	9,070	6,250	25,530
September 30	12,990	4,610	6,160	23,760
November 2	8,920	6,210	5,330	20,460
November 30	0	110	0	110
December 30	0	80	0	80
Total Kilowatt-hours—158,700.	Car-miles—13,280.			
January 31, 1915	90	60	60	210
February 27	0	0	0	0
March 31	0	10	20	30
April 30	0	10	0	10
May 30	5,370	8,030	9,140	22,540
June 30	12,010	7,870	7,170	27,050
July 31	11,210	8,530	6,450	26,190
August 31	10,460	8,490	6,030	24,980
September 30	10,160	7,600	6,090	23,850
October 31	5,030	5,010	3,340	13,380
November 30	3,160	10	3,710	6,880
December 31	0	0	70	70
Total Kilowatt-hours—145,190.	Car-miles—11,625.			

In Table No. 1 the earned rate per kilowatt-hour for each year was for 1911, 2.48 cents; for 1912, 2.22 cents; for 1913, 1.8 cents; 1914, 1.76 cents, and for 1915, 1.78 cents, and by using these figures in estimating the cost of electrical operation for a season's run we get for 1913, $2,208.14; 1914, $2,793.12, and for 1915, $2,584.38.

A study of Table No. 1, however, will convince one of the incorrectness of this estimate. Central-station charges are made up of two factors, a demand charge and an energy charge. From a study of the table we find that the average maximum increase for elevator-pump operation for the three years, as indicated by increase between April and May readings and decrease between October and November readings of each year, has been about 73 kilowatts and the energy consumption has all been on the low-rate portion of the contract. The actual income to the central station, and hence cost to the customer, must therefore be figured on this basis and corrected, would be for 1913, $1,523.90; for 1914, $1,731.40, and for 1915, $1,652.36.

TABLE NO. 3.

	1910	1911	1912	1913	1914	1915
Coal	$39,856.89	$21,240.34	$17,928.82	$14,031.28	$17,228.55	$15,023.43
Oil	1,420.54	628.19	597.93	474.01	458.97	326.82
Water	3,319.09	2,518.98	2,441.13	2,499.60	2,690.93	2,011.47
Packing	739.02	315.43	458.11	228.44	219.31	269.04
Total	$84,368.94	$65,552.25	$69,982.09	$63,059.72	$59,277.12	$55,187.77

The items in Table No. 3 are exactly as taken from the books of the Hillman department store and cover only such data as are pertinent to the question in hand. The total operation expense is included in order to show the saving and continual reduction in operating costs resulting from the use of central-station service. It includes all labor, repairs, maintenance, central-station service and upkeep as charged against the plant. The increase in 1912 over 1911 was due to an increase in labor of $3,200 and pipe work of $1,350 on account of changes being made in the building and handled by the building force.

In Table No. 3 note the various changes and their cause. 1911 denotes a considerable drop in all items listed due to central-station operation with a further drop in 1912 and 1913 due to plant equalization.

In September, 1913, steam service was supplied to the Reliance Building, adjacent, and the increase in coal and water for 1914 is due to this. In 1915 reductions are again made in the items as listed and due again to equalization and plant improvements. Here the water bill has been materially reduced and its effect apparent on the coal bill due to the piping of all steam line returns back to the hot well. Also an electric pump, the equivalent to the three pumps in the Hillman store, was installed in the Reliance Building to be used for elevator operation, thereby reducing the amount of steam required for summer operation on that part of the plant.

So far there can be no question as to the figures and data presented for they are all a matter of record. From now on estimates and assumptions must be made and these of course will be subject to more or less criticism. There

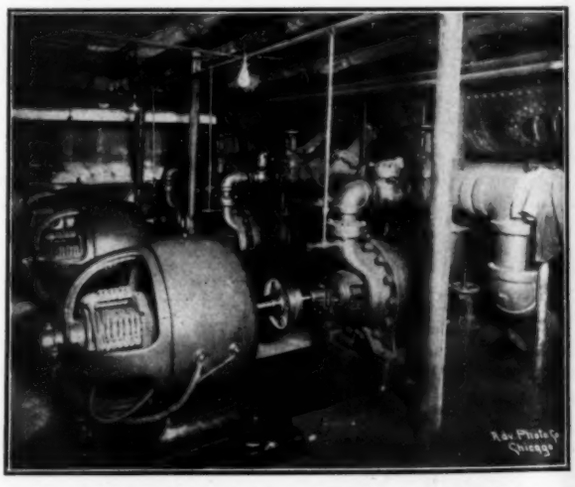


Fig. 3.—Battery of Motor-Driven Pumps for Operating Hydraulic Elevators in Western Union Building.

is this to say, however: the figures are all here and any one so desiring may work the problem out for himself.

The bare cost for steam production per 1,000 pounds based on a year's average and including only coal, ash removal, water for making and boiler compound, but not including any labor, maintenance or repair, or overhead investment on plant, was 24 cents per 1,000 pounds with coal at $2.85 to $3.05 per ton.

During the winter months there is no question as to the value of exhaust steam for heating purposes where it can be used to such good advantage as in this installation, but in summer there is absolutely no need for this exhaust, there being ample return from the balance of the system so this part of the plant operation would show a dead loss so far as exhaust-steam value is concerned.

If we assume the steam pump to be in fairly good condition and to consume 120 pounds of steam per indicated horsepower-hour, and surely no one having any knowledge whatever of steam pumps and their operation can object to this figure, then 160 pounds would be required per kilowatt-hour.

Personally from my knowledge of this equipment, its condition and operation, I am inclined to believe the true figure would be nearer 200 pounds than 120 pounds, but have assumed a figure of 120 pounds as representing possible good average practice in a plant where equipment was kept in first-class condition and covering a period of five years.

The summer operation of these hydraulic elevators for the year 1913 consumed 123,230 kilowatt-hours. At 160 pounds of steam per kilowatt-hour and at a cost of 24 cents per 1,000 pounds, with no credit for exhaust steam, the bare cost of this summer operation, using steam pumps in place of electric pumps, would have been $4,732.03. For 1914 figured in the same way it would have been $6,094.08 and for 1915, $5,575.30.

Let us put these figures on a comparison basis, as in Table No. 4, and see just what they mean.

TABLE NO. 4. HYDRAULIC ELEVATOR OPERATION, SUMMER MONTHS.

	1913	1914	1915
Estimated Steam Operation Cost	$4,732.03	$6,094.08	$5,575.30
Actual Electrical Operation Cost	1,523.90	1,731.40	1,652.36
Annual Saving, due to Electric Operation	$3,208.13	$4,362.68	$3,922.94

When this method of elevator operation was first suggested it was submitted to a recognized authority on elevator operation and was promptly returned not approved,

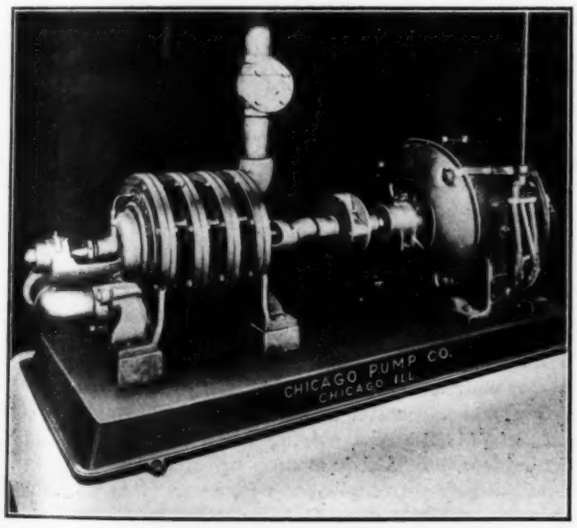


Fig. 4.—Type of Direct-Connected Pumping Unit Used Extensively in Chicago Installations.

with the statement that a loss, not saving, would be the only possible result, yet if our records be of any value we find here a saving sufficient to pay for the equipment in less than two years with the added assurance of emergency service as a plant safeguard.

These figures, excellent though they be, do not represent the entire saving due to motor-pump operation, however, for in order to be absolutely fair in the matter it would be necessary to include the savings due to the packing, waste, oil, maintenance and repair, and its proportionate rate of boiler-room operation not necessary when operated electrically.

We might even carry the problem further than the savings and emergency possibilities featured. Who has ever heard of a comfortable boiler and engine room in the basement of an office or service building during the summer months, yet such a condition is possible.

Conditions in the Western Union Building, Chicago.

The Western Union Telegraph Building, Chicago, has installed an equipment similar to that in the Hillman store, using three three-stage 350-gallons-per-minute Chicago Pump Company's turbine pumps, each direct-connected on a common subbase to a General Electric motor and each likewise controlled by a Cutler-Hammer control panel. Here again the steam pumps are operated during the winter months and exhaust steam used for heating.

The problem, however, has been carried further in this case. The entire boiler plant is shut down during the summer months and a small boiler was installed of sufficient capacity to serve the building with the necessary hot-water requirements during the summer months with the result that the boiler and engine rooms are very comfortable even during the hottest days. This equipment has now been in service two years and is giving excellent results.

Fig. 1 shows the Hillman installation. The controlling panels do not show in the illustration but are immediately to the left of the picture. Fig. 2 is of the Western Union Building installation and shows the equipment just after installation, while Figs. 3 and 4 show this same equipment with controlling panels.

Equipment in Other Chicago Buildings.

The Chicago Title & Trust Company, Chicago, has likewise contracted for a similar equipment for the summer operation of its elevators, using Lee-Courtney pumping equipment. This installation is expected to be in service by April 1, 1917.

The Chicago Bank Building has six hydraulic elevators served by three motor-driven pumps. This system, however, is of the accumulator, high-pressure type, about 800 pounds pressure, and triplex, horizontal plunger pumps are used. This equipment is electrically operated throughout the year.

The department store of Carson, Pirie, Scott & Company likewise has eight hydraulic elevators, accumulator system, operated by three triplex, horizontal plunger pumps, motor-driven, and also electrically operated throughout the year.

In St. Louis, Mo., and in New York City, several of the large office buildings are using motor-driven pumps in the operation of their hydraulic elevators.

The object of this article, however, is not to point out a few isolated cases of motor-driven hydraulic elevator equipments but to indicate to the central-station man the great possibilities in a field practically undeveloped as yet.

The Hillman case is but a concrete example of the excellent results that can be accomplished in this line. There are thousands of cases in this country similar in many respects to the Hillman problem and likewise awaiting solution. Some of these would be an addition to a load already secured in which case they would materially increase the income to the central-station company on a service investment already made, while others representing new prospects, the possibilities are so great that the featuring of the problem should materially aid in securing isolated-plant operation from central-station service. The whole problem as it now stands rests with the central-station man.

Public Service and the Central Station

A Discussion of the Principles Which Should Guide a Public Utility Company in Dealings with the Public and in Its Relationship With Its Employees

By THOMAS ROBSON HAY,
Duquesne Light Company, Pittsburgh, Pa.

A CHANGED life, a highly specialized life, has come over this country. From an agricultural and provincial community of great distances and with few outside interests, we have grown into a manufacturing community of the first magnitude, and we are now fairly settled in a mechanistic and industrial age that increasingly makes for the submergence of the individual by the exaltation of the machine.

Economic problems of supply and demand, of barter and trade, together with many other special problems having to do with this new life are present in pressing magnitude and force. The most vital of all present economic problems are the relations between the public and the public service utilities, particularly those of interchange and intercourse. As movement is life, so are intercourse and interchange the true basis of civilization and commerce.

One ever present problem and responsibility is the securing of the best method to realize the proper maintenance and the further extension of the public utility. The United States of today in all its power and magnificence has been created—its latent possibilities made tangible, its prosperity maintained, its growth continued—by or because of these means of intercourse and interchange. The maintenance and continued development and growth of the country will in a great measure be dependent upon the maintenance and continued growth of the utilities which furnish these facilities for intercourse and interchange. All other utilities or industrial or commercial enterprises are subordinate to and dependent on these fundamental, underlying phases of our industrial life. Without the public utility, such as the railroad, the telephone, the telegraph, etc., with vast resources of money and men the development of the economic possibilities of this country would have been slow and greatly retarded. The application of these vast resources of men and money has resulted in discoveries, inventions and developments that have brought into everyday use facilities which only recently had been out of reach of all but the favored few. Without these concentrated resources the economic developments realized would have been out of the question.

The Old Policy of Utilities.

In the possession of these vast powers it is not to be wondered at that often men acted unscrupulously and with regard only for their own welfare. The public was seldom considered as anything but a willing suppliant without privileges, rights or immunities and bound to be thankful for any crumbs that might come into its way. All was right and fair as between those in the places of power, but the public was not expected or entitled to any expression of resentment, of difference, or of rebuke. Now all this is changed and the public is in the saddle, and in some cases tends to the extreme formerly occupied by the public utility. Competition, control, regulation and legislation are looked on as the forces which have enabled or compelled industrial enterprises to improve and extend their service; to increase production; to pay increased wages and taxes; and at the present time to decrease the charges for service rendered. While these features have been, to some extent, a stimulus, the wonderful improvement which has been made has been coincident and indissolubly connected with the replacement of the old wasteful methods by the new methods of scientific operation. Investigation, research, and the application of the results to both operation and production have made possible a larger production from the same or less effort and expenditure, and have obtained valuable products from what had formerly been wasted.

All this economic improvement has been much to the benefit of the worker, by making for shorter hours, more pay and better working conditions; to the public served, by reducing the cost of necessities, by making life easier and more pleasant to live, and by bringing into the market necessities and luxuries of benefit and value; and to those responsible for the work, by making their incomes larger, by enlarging their field of operation, and by making it possible for the producer to have some personal share in the bringing of greater happiness and joy to life. But through it all there is a lack of consistency in the understanding respecting enterprise and initiative, and the relations between capital and labor—the employer and the employee. There are many ideals and beautiful theories which in time may be realized. But commerce and industry are dependent on the purchaser and the consumer, and so long as the human factor of self-interest, as it now exists, controls them in their dealings, so long must the effect of that same existing human factor be taken into consideration by commerce and industry in their relations with both producer and worker.

Position of the Central Station Today.

Public service enterprises are always large employers of labor and large purchasers of all varieties of products and manufactures. Their activities always contribute to the circulation of money, to employment, to production, and to consumption. In this continuous process of conversion from the raw product to the finished material, all public utilities necessarily have a very real part and interest, and in the fulfillment of this fact the public utility necessarily is continuously in contact with the public as buyer or seller, producer or consumer, or as labor.

One of the important contributing factors to this state of affairs has been the practical development and application of electricity in its manifold forms to the industrial uses of the community. Coincident with and because of this development has been the birth and growth of the central station, and by central station we mean a plant or a group of plants capable of supplying the needs and fulfilling the requirements of a community or communities, whether centralized or scattered over a given territory. In supplying such service and in fulfilling the requirements of the user, the central station naturally comes often into intimate relations with the user. In agreeing to supply such service there is the obligation on the part of the central station to give the most efficient and the most continuous service possible at a fair rate of return. And there is the reciprocal obligation on the part of the user or public to realize that the central station is endeavoring to furnish the most efficient and the most continuous service possible, and to allow it to charge such a rate as will enable it to maintain and operate a plant or system that is adequate

to meet the requirements of the user or the public, while at the same time showing a fair and reasonable net return on the investment.

Not over ten or fifteen years ago the central station was not thought of as a public utility, and service was a matter determined by the management instead of by the public, as at present. Instead of the larger corporation and holding companies operating over definite areas and with definite and continuing policies, the central station usually served restricted areas in no definite and efficient manner, and with little regard to the rights and needs of the public. Initially the service was supplied for lighting only, and was available from dusk until 11 or 12 o'clock, p. m. No adequate conception of the value or of the manifold advantages of a power load, or of 24-hour operation, was had, and no particular effort was made to secure an industrial motor load. In proportion as the central-station management conceived and appreciated the value of this day load, in such a proportion was the central station aggressive in soliciting this class of business and progressive in its standards of equipment and service, until now a central station is rarely found that does not systematically cultivate this class of business, while at the same time continuing to develop and increase the domestic lighting business and to secure municipal illumination.

At first, central-station managements were slow to realize the possibilities offered by this new field and were somewhat reluctant to co-operate to the extent of reducing rates to a point where they would be at all comparable with the existing industrial manufacturing costs for power. Gradually this industrial business increased, and in some cases in spite of, rather than because of the management.

Application of Central-Station Service Unlimited.

The initial users of central-station service were small operators, as it was not considered possible to sell this service to the large users. With the increasing efficiency of electric power plant generating equipment, and with improved methods of sales and distribution, it is now possible to supply nearly every type and size of plant with power at a cost comparable to or less than the cost of generating this service locally.

With the expansion of the central-station field and the application of its service to every use, the central station has become a public utility in every sense of the word. As such it has necessarily assumed the responsibilities attendant on the furnishing of continuous, adequate and reliable service at a fair price and without discrimination.

Before the true conception of right and fair methods and the establishment of regulating commissions, no published schedule of rates, no particularly systematized methods of doing business and no settled policies prevailed. The user or public was treated as the best interests of the central station dictated, and not according to the justice of the contention and the rights of the party or parties concerned.

A policy of *laissez faire* and the public be damned was followed, together with a peculiar system of rate-making similar to the old railroad methods of rebating, that favored the few who had power, either actual or potential, as against the array of smaller industrial users and lighting consumers who were expected to be glad to take what they could get and say nothing. With the advent of the regulating commission order has been gradually evolved from this chaotic and uncertain state by the standardization of rates and by compelling a standard of equality in treatment that favors none and serves all.

The central station exists because of the public, and it is on account of their close relationship as buyer and seller, and their mutual responsibilities of operation and regulation, that it is right and proper that they work harmoniously together to the common end, the sale and application of electricity to the real profit and convenience of both. And to this public the salesman, the line-man, the trouble-man, or whoever he may be is the central station. In all his relations with this public he must be courteous in treatment and urbane in deportment. He must continually realize and appreciate, to the fullest extent, the fact that consciously or unconsciously this public is judging the central station rather by what it knows of the central-station representative, than by what the central station's particular aims and policies may be.

Consideration for the Public.

To the average man electricity and its intricate, complicated and technical features are a closed book. The good will of all classes and conditions of men is always eminently desirable and helpful, and all members of the central-station organization have individually their peculiar responsibility to the public of right treatment and consideration; but more particularly the members of the sales department, whether lighting salesmen or power salesmen, counter clerk or complaint adjuster, as the duties of these particular men bring them into more intimate and continuous contact with the public than is the case of the members of the other more technical departments, such as the engineering, accounting and meter departments. The molding of public opinion and the determination of the individual and collective attitude of the public is peculiarly in the hands of the rank and file of the organization. Right treatment of all, regardless of social or business positions, can only be reflected in a favorable feeling on the part of the public and in the creation of a positive and favorable attitude of tolerance and forbearance under difficulties, and of broad-mindedness and consideration when additional privileges and immunities are asked for.

Always, selling is 75 per cent service and the balance product. This service initially takes the form of guidance, through courteous and truthful advice, and personal supervision and interest after a contract has been negotiated. In times of operating troubles, in the settlement of complaints and in correct explanation of outages and any occasional trouble, the central-station employee can always be of great assistance in holding the business and of helping the customer.

Users of electricity, whether industrial power or domestic and municipal lighting, rely absolutely on the continuity and sufficiency of this service for the operation of their plants or the illumination of their houses and streets, and it is and should always be the duty of the central-station management to anticipate growth by the purchase and installation of the necessary equipment to handle the increasing requirements of this public. Failure to do so can only result in great pecuniary loss and much inconvenience and dissatisfaction on the part of the public, with loss of prestige by the central station, as well as prejudicing and jeopardizing any good will that the central station may have built up in its community.

The growth of the central-station industry in the past decade has been little short of phenomenal, and the end is not yet. The success of a particular type or class of application is an advertisement and a visible example of the successful application of central-station service. New industries are constantly coming into being as potential users of this class of service, such as the electric heating and melting furnace, and old and already established industries, such as steel mills, office buildings and coal mines are increasingly finding it advisable to contract for such service, and the end is not yet. In approaching this end and in realizing its greatest fruits, the central-station management and the central-station employee have severally collective and individual responsibilities, the proper and efficient fulfillment of which will result in profit and satisfaction to all.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

ESSENTIALS IN PROMOTING ELECTRIC COOKING.

Suggestions for Inaugurating an Electric-Range Campaign From a Paper by J. H. Risser Before the Kansas Public Service Association.

Free installation of electric ranges, sold at list price, is an important item in a campaign for this business. Experience has shown that central stations where electric-cooking activity has been greatest, are willing to make this outlay to get the stoves on their lines. This can readily be appreciated when it is realized that the yearly income from a range customer is three times that from a lighting customer. Furthermore it is much easier to make the sale of the range and installation at one transaction. A customer will more readily pay a high price for a stove if the installation is free, than even a lower price for the range and an additional charge for the connection. Since electric ranges are higher in first cost than other cooking stoves, a customer who has decided to purchase an electric at a price which may have been given her, will voice strenuous objections to an additional expenditure of only $10 for the connection. When you tell Mrs. Brown that the price of this electric range is $100, Mrs. Brown at once forms a mental picture of that particular stove in her own kitchen, set up, say between the sink and the kitchen cabinet, fully connected and costing her $100 in that position.

Value of Time Payments.

The question of time payments in connection with the sale of electric ranges is also important. First, time payments have been used in the past to successfully merchandise such articles as pianos, victrolas, washing machines and vacuum cleaners, and undoubtedly the large volume of sales credited to these articles has been due in a large measure to the time-payment plan. For this reason it is very likely that similar measures adopted for and applied to electric ranges will result in the rapid acceptance of this artice by the public.

Further than this, the selling of electric stoves with time payments greatly increases the number of possible buyers. There are many customers using electricity for lighting who do not care to lay down $100 cash for an electric range, but who would be willing and glad to secure the benefits of one offered to them on monthly payments.

Service for Electric-Range Customers.

Too much emphasis cannot be placed on necessity for a careful supervision of the service to make the stoves in use a success from that standpoint. Very often the manufacturer is blamed for the poor showing of a range when the stove is not at fault, and the real trouble lies in the transformer serving that particular installation. Voltage regulation is important.

A feature which will make for contentment among cooking patrons is frequently calling at the home to see that the stove is being operated properly and giving proper satisfaction. This is especially desirable for the first few weeks after the range has been installed. This practice of frequent inspection will help, not only the one stove in a given family, but will be the means of promoting good will and recommendation which promote other installations in the same neighborhood.

One of the most important steps in inaugurating a campaign is to make a convert to electric cooking of the domestic-science teacher in the local high school or college. A demonstrator will be needed later on, and she is the logical person for this position. Besides, with her on your side, you have a start on the local school board for placing a stove in the high school itself. Remember that high-school pupils learning to cook with electricity in school will demand and secure electric ranges in the kitchens at home, their mother's first and their own later.

Next, it is well to select the most influential woman in town and sell her an electric range. Size up the prospect and make your plan accordingly. Do not take no for an answer, and do not let up until the stove is installed and used continually. Your duty now is to make this stove perform so that your customer will speak nothing but praise concerning it and your service. You may meet with obstacles here and there, but they all have been overcome by other people elsewhere and you can do the same.

The next step should be to divide the town into districts and bend every effort toward placing just one stove in each district. Use care in selecting these places, bearing in mind that results accomplished in them are to be used to sell other stoves in that community.

Of course, during all this activity, newspaper space should be used, the size and frequency of the advertisements depending on the appropriation. It is well to bear in mind that small space used often to constantly hammer home your ideas is far better than a big splash now and then.

Every public gathering which is at all suitable should be seized as an opportunity to display an electric range, and explain it to the people at that meeting. If food is to be cooked, loan a stove for this purpose, and it will sell others for you. If no food is in order, your coming forward with the means of cooking may often give the opportunity you are seeking.

Reduction in Rates of New York Companies to Be Made January 1.

The accompany table shows the present rate schedule of the New York Edison Company and the United Electric Light & Power Company, together with the proposed general rate and power rate to go into effect January 1, 1917, in accordance with an agreement recently reached with the New York Public Service Commission. A further reduction of the maximum rate from 7.5 to 7 cents, and consolidating the general rate and power rate under one schedule, may be made July 1, 1917, if business conditions warrant.

PROPOSED NEW RATE SCHEDULE OF NEW YORK EDISON COMPANY AND UNITED ELECTRIC LIGHT & POWER COMPANY.

GENERAL RATE.

Rate on Dec. 31, 1916. Kilowatt-hours	Cents	Rate after Jan. 1, 1917. Kilowatt-hours	Cents
First 900	8.0	First 900	7.5
Next 100	7.0	Next 100	7.0
Next 200	6.0	Next 300	6.0
Next 300	5.0	Next 600	5.0
Next 400	4.5	Next 600	4.5
Excess over 1,900	4.25	Excess over 2,500	4.25

POWER RATES.

Rate on Dec. 31, 1916. Kilowatt-hours	Cents	Rate after Jan. 1, 1917. Kilowatt-hours	Cents
First 450	8.0	First 600	7.5
Next 100	7.0	Next 100	7.0
Next 1,350	6.0	Next 700	6.0
Excess over 1,900	4.25	Next 800	5.0
		Next 1,100	4.5
		Excess over 3,300	4.25

Results of a Co-operative Wiring Campaign

Elmira Water, Light & Railroad Company Secures 1360 Orders for Old House Wiring in Period of Eleven Months—Campaign to Continue Next Year

By ROBERT W. HOY,
Commercial Manager, Elmira Water, Light & Railroad Company

THE results that may be expected from a comprehensive house-wiring campaign, even in localities where this phase of development is already quite marked, is exemplified in the case of the sales efforts undertaken by the Elmira (N. Y.) Water, Light & Railroad Company.

During January and February, 1916, the question of a house-wiring campaign for Elmira was considered and touched upon in all its angles, and after due and careful consideration plans were laid for what has proven to be a most successful year. The first thing that confronted the company was the high price per outlet charged by the wiring contractors. It was realized that if these prices were to prevail it would be absolutely impossible to secure the amount of business available. All the contractors were therefore invited to meet with us; we laid our plans before them and after several conferences with them, which covered a period of practically 20 days, prices were agreed upon and we started out to get the business.

We had considerable literature pertaining to house wiring and the uses of electrical appliances. This we distributed from door to door by the older boys of the high school of this city. Many evenings were taken up in this form of advertising and considerable care and supervision was given to this matter, as we were anxious that each and every landlord or tenant residing in and about the city of Elmira should have in their possession this valuable information. These high-school boys were paid 50 cents per day and worked from 3:30 p. m. to 7 o'clock. We then printed a return postcard, upon which we had itemized a 10-room house, giving the location of lighting outlets, mention being made of the style and type of fixture, dividing the total amount up into 12 monthly payments. On the reverse side of the card a list of all the electric contractors in this city was given. Above this list were the words "Select your own contractor." After these cards were distributed, we started with a quarter and a half-page advertisement in the newspapers. We had then printed about 100 catalogs showing photographs of fixtures, giving prices for all kinds of wiring. These catalogs were given to the employees in our various departments and they were to work in conjunction with the commercial department.

For each house-wiring job that the employees secured or worked up to the point of signing the contract, by others outside of the commercial department salesmen, a commission of $2 was given. This we found worked wonders. Employees worked nights and Sundays. They were not always successful in having contracts signed that were given over to the salesmen in the commercial department, but a very small percentage turned in by the employees were lost.

Big Drive Started in May.

Our real campaign did not start until May and we were successful in securing about 600 house-wiring jobs up until the first of September. We discovered that business was lagging and we decided to give to every house-wiring job that was closed during the month of September a $3.50 electric iron. We were more than surprised at the results of this month's business and due to the fact that so much had been accomplished during September, we decided to continue this over through the month of October, when results were equally as good. We then continued along

FREE THIS MONTH
A $3.50 ELECTRIC IRON
With every old house wiring contract for 5 rooms or more.
5 Rooms $12.50
Everything ready to turn on the lights. Additional rooms on same basis.
NEVER COST SO LITTLE
Don't go into another winter without electricity when you can get it at such a small cost. Do not delay until too late. This month only.
ELMIRA WATER, LIGHT & R. R. CO.
If You Do Not
Wire for Electricity
This Month, You Lose
To go into another Winter without wiring your house means far more than the terrible inconvenience of it. It means money loss to you.
5 ROOMS $12.50
All ready to turn on the light. additional rooms in proportion.
$3.50 ELECTRIC IRON FREE
With every old house contract during September if for 5 rooms or more.
ELMIRA WATER, LIGHT & R. R. CO.
What You Going to Do All Winter?
ENJOY ELECTRICITY
Or merely exist through the gloomy months without its multiplicity of comforts.
Wire Your House Now
During September Only, a $3.50
Electric Iron Free
With every contract. Act now while you can get
5 Rooms Wired $12.50
and more in proportion.
Elmira Water, Light & R. R. Co.
LAST CALL!
Almost 300 Elmira owners of old houses have taken advantage of our extraordinary September house wiring offer.
Why Not You?
There is one day remaining to obtain a
$3.50 Electric Iron Free
Investigate the September offer which closes Saturday night. Make your application before Saturday noon.
5 Rooms Wired for $12.50
More in the same proportion. You may arrange to pay in ten easy monthly payments. This price includes wiring, fixtures and everything ready to turn on the lights.
Elmira Water, Light & R. R. Co.

A Series of Newspaper Advertisements Used by Elmira Water, Light & Railroad Company in Its Successful House-Wiring Campaign.

SPECIAL ANNOUNCEMENT
Electric Wiring
Offer Continues Through October
Because there was a greater demand for the wiring of old houses than we could take care of during September, the special offer of
5 ROOMS WIRED FOR $12.50 AND A $3.50 ELECTRIC IRON FREE
will be available to every owner of an old house until October 31. Positively closes then. Fair Warning is given all, with a month ahead to make the contract. Do not delay. This price includes everything ready to turn on the lights. Many who expect later to buy more elaborate fixtures, one at a time, (as may be done), are taking advantage of this offer. No home owner or landlord can afford to let this opportunity pass.
Elmira Water, Light & R. R. Co.

One of a Series of Particularly Productive Advertisements Run During Campaign.

our original lines through November and are going to continue to the end of this year.

We were very much pleased with the success of our campaign. Up to November 30, we had secured 1,360 house-wiring jobs. These were all old houses along our existing lines.

Contractors Swamped with House-Wiring Jobs.

Contracts came in so rapidly that we actually swamped the contractors. In many instances they telephoned asking us to hold back any additional work until they were caught up with what they had already on their files, and not started. Things began to look serious and we decided to employ some wiremen to take care of the rush of business. This we did about six weeks ago and it has been the means of saving many complaints. From all indications the contractors will be working on our work until some time in January before they will be able to complete the work now in their possession.

When customer did not have any preference as to wiring contractor, we divided, as far as it was possible to do so, the contracts equally among all of them. If, however, some of the contractors were selected by the customer and they had a bulk of work on hand not started, then the division was made between those who were not so fortunate as to be selected by the customer, and were in a better position to handle the work more promptly.

Aside from the regular salary that was given the salesmen a commission was offered each of them for every house-wiring job they would secure. The commission was not to start until 50 or more contracts had been secured by each of them. Practically all of the salesmen secured enough business to get commissions.

The cost of these house-wiring jobs will average about $40 each. Although we offered to carry the accounts for each job for a period of one year with an increase of five per cent for handling the accounts, practically 60 per cent of them have paid cash for the work. We are now shaping up plans for next year's business and are going after 1,500 to 2,000 more of the homes that have been deprived of clean, clear and brilliant electric light.

Full-Page Advertisements Used by Boston Edison Company to Secure House-Wiring and Cooking Business.

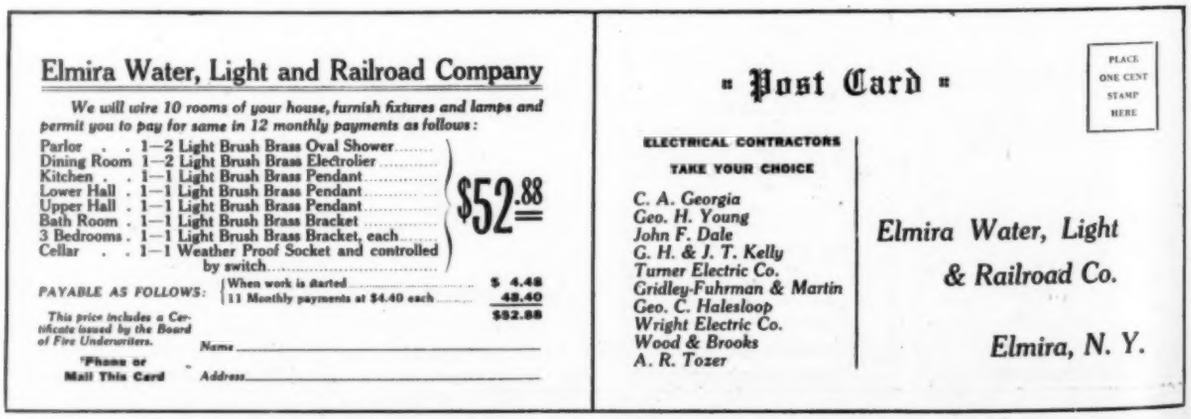
In connection with its propoganda for electric cooking and old-house wiring, the Edison Electric Illuminating Company of Boston is using full-page spaces in suburban newspapers within its territory.

A typical display advertisement of this generous size contains pictures of the attractive process of "cooking by wire," a print showing specimen fixture sets, with prices; illustrations of local homes which have been wired under the deferred payment plan, and of stores which have been given improved illumination under the same terms.

The points brought out most saliently are that any home can be furnished with electric lighting for a basic sum of $21.85, that no injury to walls and ceilings results, and that electric cooking is economical and sure.

Prizes Offered for Best Window Display.

President Guy K. Dustin of the Gas & Electric Improvement Company, Boston, has offered a series of prizes for the best window decorations in connection with Christmas week, open to the score or more of utility companies under its general management. Local managers are to secure good photographs of the windows and submit them to the Boston office for judgment.


Elmira Water, Light and Railroad Company
We will wire 10 rooms of your house, furnish fixtures and lamps and permit you to pay for same in 12 monthly payments as follows:
Parlor . . 1—2 Light Brush Brass Oval Shower
Dining Room 1—2 Light Brush Brass Electrolier
Kitchen . . 1—1 Light Brush Brass Pendant
Lower Hall . 1—1 Light Brush Brass Pendant
Upper Hall . 1—1 Light Brush Brass Pendant
Bath Room . 1—1 Light Brush Brass Bracket
3 Bedrooms . 1—1 Light Brush Brass Bracket, each
Cellar . . 1—1 Weather Proof Socket and controlled by switch
$52.88
PAYABLE AS FOLLOWS:
When work is started $ 4.48
11 Monthly payments at $4.40 each 48.40
$52.88
This price includes a Certificate issued by the Board of Fire Underwriters.
'Phone or Mail This Card
Name
Address
Post Card
PLACE ONE CENT STAMP HERE
ELECTRICAL CONTRACTORS
TAKE YOUR CHOICE
C. A. Georgia
Geo. H. Young
John F. Dale
G. H. & J. T. Kelly
Turner Electric Co.
Gridley-Fuhrman & Martin
Geo. C. Halesloop
Wright Electric Co.
Wood & Brooks
A. R. Tozer
Elmira Water, Light & Railroad Co.
Elmira, N. Y.

Two Sides of a Post Card Sent to Prospects Outlining Special Offer.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

PROPER SIZES OF CONDUCTORS AND FUSES FOR INDUCTION MOTORS.

By H. T. Hazlett.

Considerable difficulty is experienced by electricians and others engaged in electrical construction work in determining the proper sizes of conductors for supplying induction motors. There are several ways of determining these wire sizes, because not all electrical engineers and electrical inspectors agree on this matter; in fact, there is no universal rule for calculating wire sizes that will apply adequately to all motor installations.

Code Rule for Size of Wire for a Single Motor.

The required carrying capacity of wires for a single motor and for branch circuits, where several motors are to be installed, can be approximated by a simple mathematical formula, which gives results accurate enough for practical purposes. Or the wire sizes may be determined by first noting the full-load current rating stamped on the nameplates of the motors and then referring to the National Electrical Code rule 8*c*, which requires alternating-current motors taking large starting currents to be wired with conductors having a capacity of 150 to 250 per cent of the full-load current of the motors, depending on their size.

As an example, suppose a certain three-phase motor takes a full-load current of 38 amperes. The Code requirement in this case is that a wire or cable be selected having a capacity of 200 per cent of 38 amperes, or $2\times38=76$ amperes; then, according to the Code rule 18, Table A, which gives the capacities for rubber-insulated wires and cables, we find No. 3 B. & S. is the proper size conductor. But, according to rule 8*c*, this wire may be protected by a fuse or circuit-breaker rated in accordance with Table B of rule 18. If the motor is not under competent supervision or located in an engine room where there are skilled attendants, fuses should be provided in place of the circuit-breaker. The fuse in this case may be of 100-ampere capacity. A fuse having a capacity of 225 per cent of the rating of the motor would probably be large enough.

Code Rule for Feeders for a Group of Motors.

To determine the capacity of main feeders where several motors are supplied, the full-load currents of all motors should be added or a reliable diversity-factor determined, which will enable one to find the total load of all motors that may possibly work at the same time. Then select a conductor in accordance with Table 18A. This conductor must be large enough to handle also the starting current of the largest motor without it being necessary to fuse above its allowable carrying capacity. This is on the assumption that not more than one motor is started at one time, which is usually the case. However, if it is quite likely that several motors are going to be started together, the main feeders must have sufficient capacity for this purpose.

In this article will be figured the conductor capacity for three different alternating-current motor problems: two single-phase motors, two two-phase motors and two three-phase motors. The polyphase motors will be assumed to have an efficiency of 90 per cent and a power-factor of 85 per cent; the single-phase motors an efficiency of 80 per cent and a power-factor of 80 per cent. The polyphase motors are supposed to be squirrel-cage types, and started by autostarters. The single-phase motors are supposed to be the usual repulsion and split-phase types, requiring large starting currents, and on account of not having a greater capacity than five horsepower, will not need a starting device, but may be switched directly onto the line.

Determining Current of Motor.

Three well known formulas used in determining the current in an alternating-current circuit will be used. These formulas, when properly applied to alternating-current motor circuits, will give sufficiently accurate results since they assume the usual balance between phases of polyphase motors.

These formulas are:

single-phase motor.....$I=W/(E\times PF)$
two-phase motor.....$I=W\times0.5/(E\times PF)$
three-phase motor.....$I=W\times0.58/(E\times PF)$

where I=amperes per wire,
E=volts per phase,
W=watts power rating of motor,
PF=power-factor.

The current taken by an induction motor will depend on the efficiency and the power-factor, or the product of the efficiency and power-factor gives what is called the apparent efficiency. The apparent efficiency may be used in the formula in place of the true efficiency. The apparent efficiency is very useful and necessary in calculating the current-carrying capacity that transformers and conductors must have that supply the motors considered.

Problem With Single-Phase Motors.

Suppose we wish to know the wire sizes for two single-phase, 220-volt motors, one of 3 horsepower and one 5 horsepower. One horsepower=746 watts; therefore 3 horsepower=$3\times746=2{,}238$ watts. $I=W/(E\times PF)=2{,}238/220\times0.80=12.7$ amperes=full-load current, if the power-factor were 80 per cent, but the efficiency of 80 per cent calls for additional current; therefore $12.7/0.80=15.8$ amperes, the actual full-load current.

In order to comply with the National Electrical Code rule, we must select a conductor having a capacity of 250 per cent in excess of the motor rating or $2.5\times15.8=39.5$ amperes. According to Table 18A of the National Electrical Code, this three-horsepower, 220-volt, single-phase motor should be wired with two No. 6 B. & S. rubber-covered wires, which are permitted to be fused to 70 amperes to allow for the starting current. However, the starting current is not likely to be over 40 amperes, so a fuse of this size should be used.

The Chicago Code rule requires two No. 10 B. & S. wires for this size and type of motor. This is because the Chicago Electrical Code requires only 50 per cent overload capacity in the conductors for all alternating-current motors.

The method of figuring the five-horsepower motor is the same as just described for the three-horsepower motor, and it will require two No. 4 B. & S. wires, which may be fused to 90 amperes to allow for starting, although a 65-ampere fuse will provide sufficient margin for this purpose.

Feeder for Two Single-Phase Motors.

The main feeder supplying these two motor circuits should be selected of sufficient capacity so that it will not be necessary to overfuse when the larger motor is started. There is some difference of opinion as to whether this requires the main

feeder to provide for the starting current of the largest motor plus the full rated current of all the other motors. Assuming this to be the case, we must provide for 250 per cent of 26.3 amperes (which equals 65.7 amperes, assumed maximum starting current of the larger motor) plus 15.8 amperes, or a total of 81.5 amperes. This requires No. 2 B. & S. rubber-covered wire, or No. 4 B. & S. wire when other insulation is used.

However, in many inspection departments, for example, in the Chicago district, the requirements are not so rigid. Here it is believed that the main feeder must take care of a safe overload margin, say 50 per cent, on the aggregate rated full-load currents of all the motors, provided that this size is large enough to take care of the starting current of the largest motor. This rule is based on the assumption, which is true in nearly all cases, that not more than one motor in the group is started at one time and that the provision for the overload takes care of this.

Problem With Two-Phase Motors.

For the next problem suppose we wish to calculate the sizes of conductors for two two-phase, 220-volt motors, one of 15 horsepower and one 20 horsepower. 20 horsepower=20×746=14,920 watts. 14,920×0.5/(220×0.85)=39.8 amperes, or, for convenience, 40 amperes. 40/0.90=44.4 amperes actual full-load current each circuit of the two-phase motor will take if 90 per cent is the efficiency and the power-factor is 85 per cent.

Now in order to comply with the National Electrical Code requirement in rule 8*c*, we must select a conductor that has a capacity of 200 per cent of 44.4 or 2×44.4=88.8 amperes. Referring to Table 18A of the Code, we find that 90 amperes requires a No. 2 B. & S. wire. This shows that a 20-horsepower, 220-volt, two-phase motor should be wired with four No. 2 B. & S. conductors, which may be protected (in accordance with Table 18B) by 125-ampere fuses.

Polyphase motor branch circuits should not be fused higher than 225 per cent of the rated capacity of the motor. Some auxiliary protection should be provided for the motor, such as running fuses, circuit-breakers, or circuit-opening relays. Thus the motor will be protected against excessive starting and running overload currents.

The method of calculating the conductors for the 15-horsepower motor is the same as just explained for the 20-horsepower motor. It will take a full-load current in each phase of 33 amperes and the conductor must have carrying capacity for 200 per cent of 33 or 66 amperes, which will require four No. 4 B. & S. wires or cables.

Feeder for Group of Two-Phase Motors.

The main feeders in this case must have sufficient capacity for the sum of 33 amperes, the full-load current of the 15-horsepower motor, and 90 amperes, the assumed starting current of the 20-horsepower motor, or 123 amperes. This requires four No. 0 B. & S. conductors for the main feeders.

As already intimated, a very good way to determine the capacity of main feeders where several motors are supplied at the same time, is to add the full-load currents of all the motors, with the exception of the largest motor supplied, then to this sum add the starting current of the largest motor, and from this last result a conductor can be selected of sufficient capacity.

If a group of motors consists of machines that are all of the same capacity, then multiply the full-load current of any of the motors by one less than their number, and to this result add the starting current of the one motor.

Problem With Three-Phase Motors.

In the next and last problem will be calculated the capacity of conductors for two 220-volt, three-phase motors, one of 15 and one of 20 horsepower, each operating at a power-factor of 85 per cent and an efficiency of 90 per cent. Let us consider the former. 15 horsepower=11,190 watts. 11,190×0.58/(220×0.85)=34.7 amperes. 34.7/0.90=38.5 amperes actual full-load current per terminal that this motor will take. 200 per cent of 38.5=77 amperes the capacity the branch circuit must have, which requires three No. 3 B. & S. conductors.

The method of figuring the sizes of conductors for the 20-horsepower motor is the same as already explained for the 15-horsepower motor. The larger motor will take a full-load current of 51 amperes per terminal, and the branch-motor circuit must have capacity for 200 per cent of 51, or 102 amperes, which requires three No. 0 B. & S. conductors.

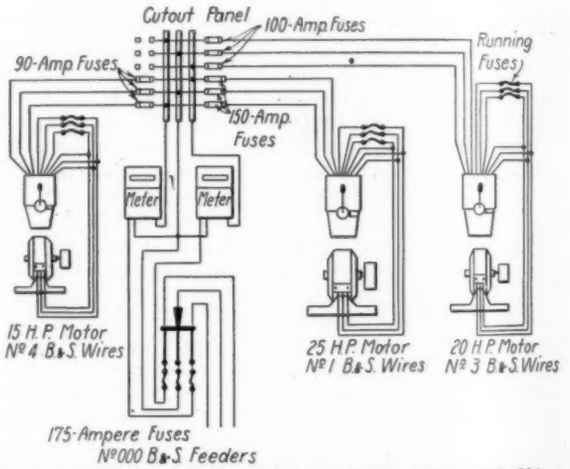
The main feeders should be large enough for the sum of 38.5 amperes, the full-load current of the 15-horsepower motor, and 102 amperes, the current that the 200-horsepower motor will take when starting; this total of 140.5 amperes requires three No. 00 B. & S. conductors.

Reasonableness of Requirements.

The figuring in this article has been done strictly according to the requirements of the National Electrical Code. However, there is no doubt in the writer's mind but that some of the conductors called for are excessive in size, which only entails an unnecessary expense in their installation. The average electrical inspector is needlessly alarmed over high-peak currents, such as motor-starting currents, which almost invariably have only instantaneous values and are therefore negligible, so long as they do not cause excessive voltage drop or persist long enough to blow the normal fuses of the circuit. These requirements can not be reduced, however, until the National Electrical Code is revised or more liberally interpreted in this regard.

Requirements in Chicago.

The accompanying diagram illustrates the induction-motor wiring requirements in the city of Chicago, Ill. Although in this city there is no insistence on the running fuses indicated in



Wiring of Group of Induction Motors in Accordance with Chicago Practice.

the diagram, some form of approved protection should be provided to protect the motor against overloads. The conductor capacity for these motors was determined as follows, assuming the full-load current of each motor to be: for 15 horsepower, 38 amperes; 20 horsepower, 51 amperes; 25 horsepower, 64 amperes; the total full-load current in the main feeders will be 153 amperes, which requires three No. 000 B. & S. conductors, if the insulation is rubber. This way of calculating overloads the main feeders for a moment by ten amperes when the 25-horsepower motor is started while the other two smaller motors are already running and drawing their full-load rating in amperes, but the 175-ampere fuses in the main feeders afford proper protection.

The branch-circuit capacity in this case was determined by providing for 50 per cent above the full-load current rating of each motor to allow for overloads that may be imposed; in other words, multiply the rated full-load current by 1.5 and select a conductor in accordance with the carrying capacity of conductors recommended in the tables of rule 18 of the Code.

INGENIOUS EMERGENCY MOTOR CONTROL SET TO REPLACE A CONTROLLER DESTROYED BY FIRE.

By O. F. Dubruiel.

Fires, breakdowns and other emergencies frequently present very interesting and difficult problems to the electrical man. Such a problem was presented to me the other day when I was called upon by the manager of a nearby shop that was using a 200-horsepower, three-phase, 60-cycle, 440-volt, induction motor which supplied all the power in the shop. A fire had just destroyed completely nearly all of the starting equipment of the controller and particularly the magnet switches.

Upon calling up by long-distance telephone, the manufacturers of the controller outfit told us that it would be 15 weeks before they could ship another set of magnet switches and a new master controller. Since this would mean shutting down the plant entirely and throwing out of employment its 600 workmen, it was a very serious matter. I was therefore asked to do anything possible to aid in starting up the motor.

In the accompanying diagrams, Fig. 1 shows the wiring of the control gear that was used before the fire. The second diagram, Fig. 2, shows how the control was arranged for emergency operation until a new set of magnet switches could be obtained to replace those destroyed. It will be observed in Fig. 2 that the control was arranged with four points. It was found possible to use the choke coils and autotransformers that were originally installed in connection with the motor. The temporary controller was made up from two old street-car controllers that were rebuilt and fastened together in a wooden barrel. This controller was covered with transil oil and the motor is being started with no more trouble than with the regular equipment. Removal of the destroyed equipment and the making up of this temporary controller and the complete rewiring required the work of two men for 26 hours.

Co-operation Between Engine Manufacturers and Electrical Concerns.

A Kansas City manufacturer of gas engines has evolved a co-operative plan by which purchasers of engines get expert service with reference to electrical equipment. When a customer asks, at the beginning of negotiations, for engine and electrical generating equipment, the engine manufacturer gets in touch with a company that can supply the electrical features, and turns the prospective contract over, specifying only with reference to the gas engine.

"In many cases," he says, "we find that the sale can be closed and the installation effected more easily by the electrical companies than by ourselves, and we are very ready to turn the contracts into their hands. While our men are competent to sell the electrical equipment and make the installations, we prefer to let the other companies get into personal touch with the customers—though, of course, we always stand back of our engine equipment. We are engine makers."

Starting Automobile Through Toy Transformer.

Necessity often forces us to realize that there are ways other than the conventional of attaining our desires.

One very cold day recently I attempted to start my automobile (which had been unused for a week) on dry batteries; I had not realized that the latter were so far gone. The day was Sunday and the supply shops closed, so I was forced to find some substitute for batteries or forego my trip. The auto will start easily on the magneto, when the engine is warm and the oil flows readily, but when cold it simply "can't be done."

Remembering that I had just purchased a small transformer for the operation of Christmas toys, and that there was alternating current available in my garage, I removed the batteries and put the transformer in place of them. With the line side attached to the portable lamp socket, and the low-voltage side to the battery wires on the car, I had no trouble to start the engine. George R. Brown.

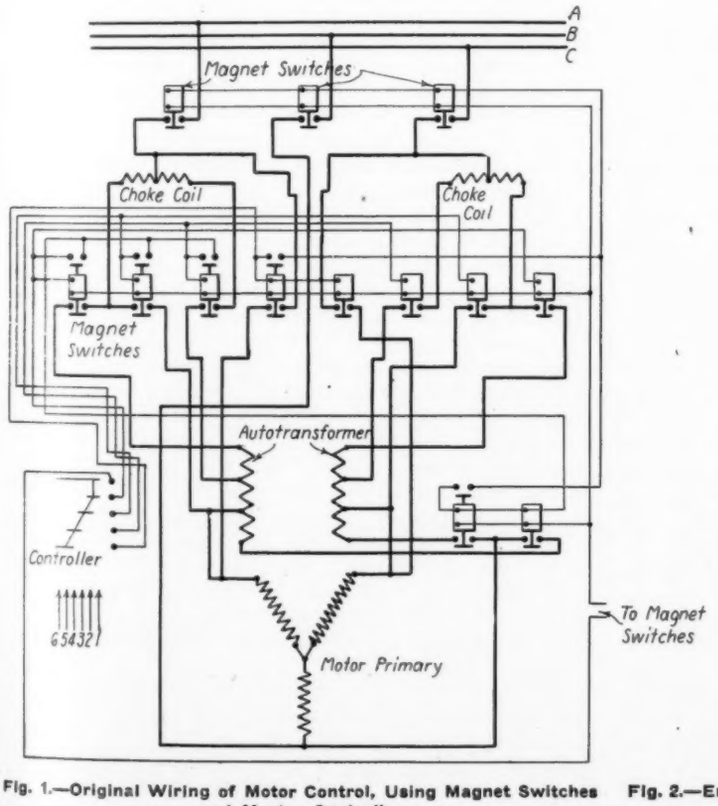


Fig. 1.—Original Wiring of Motor Control, Using Magnet Switches and Master Controller.

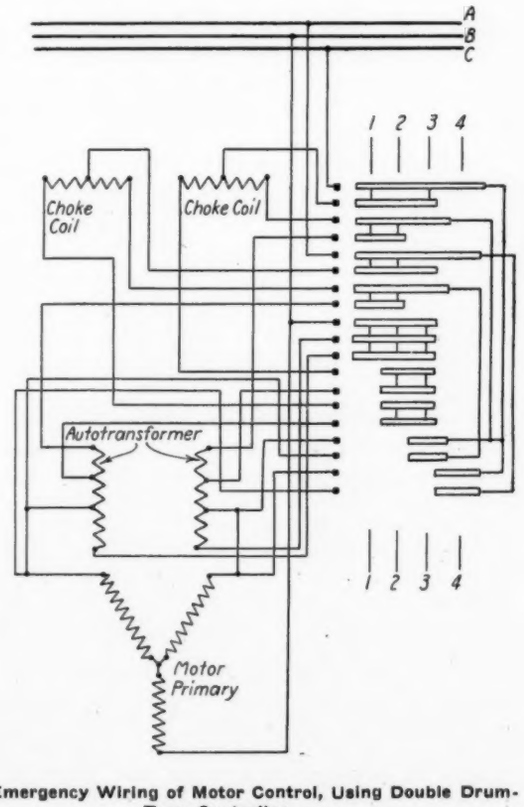


Fig. 2.—Emergency Wiring of Motor Control, Using Double Drum-Type Controller.

Boston Edison Company Issues Wiring Table for Ranges.

A schedule showing sizes of wire to be used to connect electric ranges, with loads from one to 20 kilowatts, has been issued by the Edison Company of Boston in card form suitable for vest-pocket use. On the reverse is a map of Boston Edison territory.

WIRING TABLE
FOR
ELECTRIC RANGES

220 VOLTS

	Size of Wire						
Load K. W.	No. 14	No. 12	No. 10	No. 8	No. 6	No. 4	No. 2
1.0	191	304	484	770	1220	1940	3100
1.5	127	203	322	513	815	1290	2060
2.0	95	152	242	385	610	970	1550
2.5	76	121	193	308	488	775	1240
3.0	63	101	161	256	406	647	1030
3.5		87	138	220	349	555	886
4.0		76	121	192	305	485	775
4.5			107	171	271	431	690
5.0			96	154	244	388	620
5.5			88	140	222	352	564
6.0				128	203	323	517
6.5				118	188	298	477
7.0				110	174	277	443
7.5				102	163	258	414
8.0					152	242	388
8.5					143	228	365
9.0					135	215	344
9.5					128	204	326
10.0					122	194	310
10.5					116	185	295
11.0					111	176	282
11.5						168	270
12.0						161	258
12.5						155	248
13.0						149	239
13.5						143	230
14.0						138	221
14.5						133	214
15.0						129	206
15.5							200
16.0							194
16.5							188
17.0							182
17.5							177
18.0							172
18.5							167
19.0							163
19.5							159
20.0							155

DIRECTIONS

1. Find total load in K. W.
2. If odd value, use next higher.
3. Measure actual distance along run from load to service entrance switch.
4. Opposite load from table find smallest size wire allowable for that distance

EXAMPLE

5 Kilowatts 100 Feet

Opposite 5 K. W. find distance next larger, it being in this case 154. At head of this column find wire size The result being No. 8.

Convenient Table for Finding the Proper Size of Wire to Use in Wiring Electric Ranges Without Excessive Line Drop or Heating of Leads.

The directions for using the table are first to find the total load in kilowatts, and if odd value, use next higher. Then measure the length of run from the service entrance switch to the load, and on the table, opposite the given load, find the smallest size of wire allowable for the distance. The table is found very useful by the hundreds of contractors who are interested in the introduction of electric ranges.

Improvised Elevator Control.

I had occasion recently to install a motor for a small freight elevator. The firm did not want to go to the expense of providing an automatic controller, so it was up to me to figure out some way to control this motor from more than one floor. It was a three-horsepower, three-phase, induction motor. I put a three-pole, 30-ampere-knife switch in a steel box at the bottom of the elevator shaft on the ceiling of the cellar and flush with the side of the shaft. I slotted this box so that the switch handle would extend through and work up and down. I then secured a quarter-inch rod, 20 feet long, which was the desired length. I cut a groove around the switch handle, heated the end of the rod and bent it around the handle. I then got some pieces of strap iron, drilled each so the rod would go through it, bent an ear on the other end to permit nailing it to the elevator shaft. By pulling up the rod would close the switch, by pushing down it would open it. This has worked very successfully.

George M. Hancock.

Among the Contractors.

Frank J. Flood, who three years ago organized the E. D. Berrigan Company to engage in electrical contracting business in Syracuse, N. Y., has acquired control of that company, which hereafter will be conducted under Mr. Flood's name. In the reorganization the capital stock of the firm is increased from a nominal sum to $6,000, with which the new company starts business.

The Southern California Electric Company, Los Angeles, will install the electrical work in the new Los Angeles County Hospital.

The United Electric Construction Company, Philadelphia, Pa., has been awarded a contract for the installation of electrical equipment at the new service station of the Packard Motor Car Company, Broad Street, Philadelphia, at a cost of $10,000.

B. E. Dunham, manager of the electric shop in Brainerd, Minn., has opened a branch store in Ironton, Minn., the business to be conducted under the name of the Ironton Electric Supply Company.

The contract has been let to J. L. Wilson of Los Angeles, Cal., for the installation of ornamental posts and lighting system on West Adams Street between Grand and Figueroa Streets in that city.

The Thew-Luhr Electric Company, Omaha, Neb., has changed its name to the Luhr & Luhr Electric Company, E. W. Luhr continuing as president and general manager. The company carries a line of electrical supplies and fixtures, and does contracting and engineering work.

The K-W Electric Company, Newark, N. J., reports an exceptionally busy season in its electrical contracting and engineering departments. Among important jobs recently completed or nearing completion are the following:

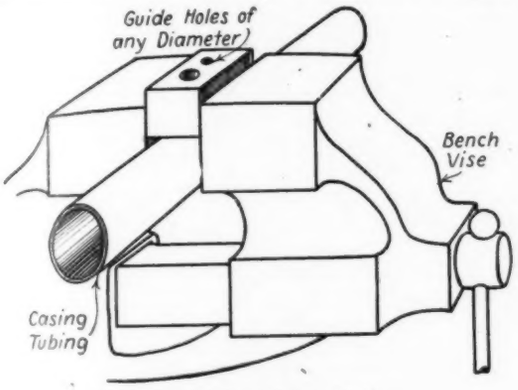
For the Hyatt Roller Bearing Company, Harrison, N. J., the firm is putting in a complete electrical installation in iron conduit in two new eight-story buildings for 1,428 100-watt lighting units for general illumination and 650 individual lamps for the testing department and machines; also 925 horsepower in motors. At the Seton Leather Company's plant in Newark there is being changed the direct-current plant, consisting of over 300 horsepower to a two-phase, 220-volt system connected to the Public Service Company's lines. At the Tanner Leather Company's new plant in Newark there is being installed power wiring for 200 horsepower. For the Hanovia Chemical & Manufacturing Company, Newark, there has been completed the installation in a new three-story mill-constructed building of all the light and power wiring in galvanized iron conduit; in this installation, Condulet fittings were used throughout. In the Hillier Rough Dry Laundry building in East Orange, N. J., there has been installed an isolated plant complete with switchboard, generator and approximately 40 horsepower in individual and group-drive motors. For the Lowe Paper Company of New Jersey the firm is installing a direct-connected 250-kilowatt generator complete with up-to-date switchboard, two sub-feeder switchboards, and 200 horsepower in individual motors. This electrical installation throughout was planned by A. H. Koellhoffer, electrical engineer and president of the K-W Electric Company; and it is based on the most modern methods.

DOLLAR WIRING KINKS

Every reader is invited to contribute to this page. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Guide for Drilling Fixture Casing.

To accurately and quickly drill holes in casing or tubing used in fixture work I make use of the following device. Drilling is most always done at the work bench with a breast drill on stock-size casing (three-fourths inch) for two sizes of holes, one-fourth and one-eighth inch. By drilling a slightly larger hole through a piece of steel, or any other metal, whose width is the same as the diameter of the casing, you have a guide for the drill and center for the casing. Steel guide and casing are secured in the same bench vise or wooden cabinet maker's clamps; this



Guide for Drilling Fixture Tubing.

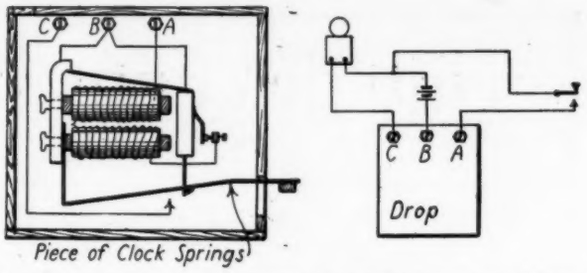
is shown in the accompanying sketch and is self-explanatory. The hole drilled on the bottom side of the casing is in line with the one on the upper side and there is no danger of breaking the drill. Robert Oster.

Adjusting Length of Fixture Chain on the Job.

Fixture chain can be made up very nicely at the shop, where there is a vise to work with, or you have two good pairs of pliers for bending links open. When you get on the job and find that you have carelessly left one pair of pliers on the shop bench, you will find it difficult properly to open and shut the links for adjusting the length of the chain. This can be overcome very nicely as follows: Place a little paper, cloth or leather around the link that is to be opened, so that it will not be easily marred, and place one side of it between the jaws of your brace, then with the aid of your pliers you can open and shut the links with little difficulty. Ray E. Smith.

Converting an Old Bell Into an Automatic Drop for Constant-Ringing Bell System.

The following is a method of converting an old electric bell into an automatic drop for constant-ringing bell systems. An ordinary bell is taken and the gong is removed. The clapper is cut down and bent over in the form of a hook. Now a piece of clock spring, spring brass, or anything that is springy, is taken and one end is fastened to the yoke of the coils; the other end is brought over to where the clapper had been cut down. Now the hook and the spring are adjusted so that when the latter is raised up, the hook on the clapper will catch it. As soon as the



Old Bell Converted Into a Relay Drop for Constant-Ringing System and Method of Wiring Circuit.

button is pressed so that the current goes through the coils and the armature is attracted, the spring, which had rested on the clapper before it was attracted, now drops and falls on a contact from binding post *C*. Now the current goes through the shortest way, which is formed by the new contact, and keeps the bell in circuit ringing constantly. Spring extends outside the box and a small piece of brass or the like is soldered on so that when it is desired to stop the bell ringing the clock spring is pushed up and held by the clapper hook. Morton Schwam.

Enlarging Holes in Outlet Boxes.

I have seen many wiremen cut holes in cabinets, outlet boxes, etc., with a cold chisel; this batters up the box and does not make a neat or satisfactory job. If it is desired to enlarge a hole for a larger size conduit, a pipe reamer is the best thing to use as it makes a neat job and if the box is already set, will not jar it loose. If new holes are to be bored in a box or cabinet, drill through the box with a small bit and ream the hole to the size required; or use a special tool designed for this purpose, such as the one described on page 1023 of the December 9 issue, which is a good tool. H. L. Metcalf.

Knife for Cutting Off Insulation.

In cutting insulation off wire, one often cuts too deep. A good tool for this work can be made by mounting an old safety-razor blade in a handle, as shown in the sketch. Cut a slot in the end of a piece of hard wood and shape the other end for a comfortable handle. Mount the blade in the slot so that the cutting edge will project the proper

Using Safety-Razor Blade as Insulation Cutter.

amount; the edges of the wood then serve as a guard to fix the depth of the cut and to prevent cutting into the wire. This is especially useful for lamp cord and other small wires. L. M. Dellinger.

Counting Device for Coil Winder.

A counting machine may be easily made from a register train from an old watt-hour meter. All that is necessary is to make a connection from the shaft of the device that it is desired to know the revolutions of to first wheel or hand spindle on the register train. This may be accomplished in many ways. One method is to solder a small wire to the shaft and run it to the spindle; another is to connect a small coiled spring direct to the first hand on dial and run it to the shaft.

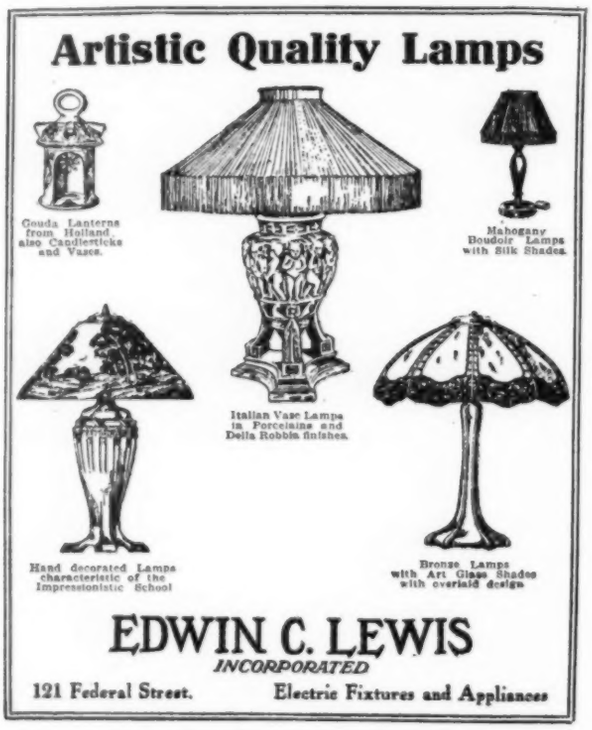
I have one attached to my coil winder; it was taken out of an old Sangamo meter and has the shaft extended to the spindle. It is very convenient, as on this type the hands are held on by friction and may easily be set to zero. H. L. Metcalf.

THE DEALER AND STOREKEEPER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Store-Keeping for the Dealer in Electrical Goods

Electrical Gifts Featured for Christmas.

Several dealers and jobbers in electrical wares at Boston are pushing their goods as being desirable and appropriate Christmas gifts. Among these are the Pettingell-Andrews


Artistic Quality Lamps
Gouda Lanterns from Holland also Candlesticks and Vases.
Mahogany Boudoir Lamps with Silk Shades.
Italian Vase Lamps in Porcelains and Della Robbia finishes.
Hand decorated Lamps characteristic of the Impressionistic School
Bronze Lamps with Art Glass Shades with overlaid design
EDWIN C. LEWIS
INCORPORATED
121 Federal Street.
Electric Fixtures and Appliances

A Boston Dealer's Christmas Advertisement.

Company, Edwin C. Lewis, Incorporated, Farley & MacNeill and the McKenney & Waterbury Company. These concerns, and others, recognize the attractive combination of utility and beauty embraced by electrical domestic appliances, lamps, etc., and are using advertising publicity, suitably illustrated, with good effect.

Utilizing the Entrance Door as a Part of the Available Display Space.

An interesting use for a small projector light is suggested by a "spot-light" display development worked out by the manager of a store in the East. There is a show window on each side of the entrance to the store, the door as usual being little more than a sheet of plate glass. The manager was conscious of the fact that the space back of this door was not doing its duty at night as a display space and, after some thought, has worked out a scheme that is proving satisfactory and, incidentally, is suggestive to electrical dealers as well as lighting appliance salesmen. An ordinary 60-watt lamp in a bell shade was placed on a bracket over the door, and directed in such a way as to shine directly on an item of stock which rests on draped velvet on the top of a stand placed just inside the door. This stand is placed close enough to the door so it can be conveniently managed by a man with an arm inside as he stands outside just before closing.

It is really surprising how this particularly featured article stands out against the darkness of the interior and how good an effect it produced by the supplemental display. The possibilities of supplementing the ordinary window display in this manner will readily occur to the electrical dealer. The extra light may burn all night or may be attached to the window circuits.

Possibilities in the Automobile Accessory Field.

The experience of the Spitfire Battery Company, located on Diversey Boulevard in Chicago, is interesting, because it shows how the demand for electrical service in the automobile field is growing. This concern was started, as the name indicates, to sell, recharge and repair storage batteries for automobiles. However, owners began coming in for service in connection with other electrical equipment, including starting motors and generators, and now the company is taking care of business in the whole electrical field as it pertains to motor cars. A well-equipped repair shop has been put in for the purpose of providing the necessary machine work, and nothing has to be sent outside. Armatures are rewound and magnetos repaired and all of the other details of ignition, starting and lighting service are taken care of. Those in charge of the business have found a prolific field for their efforts, and the success of the venture seems to demonstrate that this is a growing line, the possibilities of which are almost unlimited.

Window Signs Catch the Public Eye.

Something out of the ordinary always attracts attention. The show window offers exceptional opportunities for exhibiting original ideas for catching the eye of the public. The accompanying illustration shows one of three windows of Cahn-Forster Electrical Company, of Denver, Colo., on which large incandescent lamps were painted in colors. These attracted attention and secured interest not only in electric illuminants but in the varied assortment of electrical appliances shown in the window.

An Attractive Denver Window.

Business Hints for the Electrical Dealer

Giving Employees Access to Trade Papers—An Extra Margin of Profit on Christmas Goods—To Display Price Cards or Not to—Electric Radiators for Ticket Booths

By G. D. CRAIN, JR.

"I WISH I had a chance to see the trade papers regularly," said the man in charge of retail sales of a certain electrical store. "The boss takes the paper, and lets me see it about once in a blue moon. I haven't the money for subscriptions, but I believe it would pay the house if I could read about what other people are doing right along."

This concern is typical, in that it has developed from a contracting and supply house into one which handles a large volume of retail business. The heads of the house have turned this department, the merchandising end, as it might be described, over to the young man referred to. He is keen and eager, and is doing his best to make good. He realizes, however, that he needs help, and that he could get the right kind from the trade papers. Unquestionably it would be a good investment for the house to see that he has a chance to read them.

Many young men like him have come to the front with a rush in the past few years. They have inherited the job of selling at retail because there has been nobody among the older men able or willing to look after the multitudinous details which it involves. These boys may not be considered the most important cogs in the electrical wheel right now—but in five or 10 years they will be the big men of the trade. Consequently it is worth while from the standpoint of the electrical house to give them every opportunity to develop, so that their work may be of the maximum value and usefulness.

Speaking of the trade journals, one of the best ways to make use of a single subscription is to paste a slip carrying the names of all those who should see it on the front cover of each paper as it comes in. The paper is first read by the president, and goes on down the line, the executives higher up marking certain articles which they desire to call to the attention of others in the organization. It takes some time for the "circulation" to be completed, but the value which is developed from the paper is great, and the house profits through the dissemination of the information.

Pricing Christmas Goods.

The question was recently raised as to whether the dealer is justified in pricing goods which are put in stock exclusively for the Christmas trade at a higher margin of profit than ordinary staple merchandise. There is no doubt that such goods ought to carry a large margin, and the reasons are very clear.

In the first place, goods put in stock for a particular time, especially when the period during which sales are to be made is short, involve a considerable risk. If the stock is not sold out they have to be carried over until the next year, the investment thus being dead for 12 months. This alone is a strong argument in favor of pricing up a little more than usual.

In addition to this, toys and novelties of various kinds suffer from obsolescence. A proposition that may look mighty good right now is likely to drop clear out of sight before next year. This risk must be taken care of by a greater margin than would be necessary under ordinary conditions.

Then, too, there is the question of supply and demand, which often enters into the situation. With a staple article, selling for long periods, if not continuously, nobody has a monopoly of trade; yet in the case of Christmas selling the concern which finds itself with a corner on tree-lighting outfits at the eleventh hour, for example, can, if it so chooses, sell them at a much higher price than they would ordinarily bring. Whether or not this is good policy is another question.

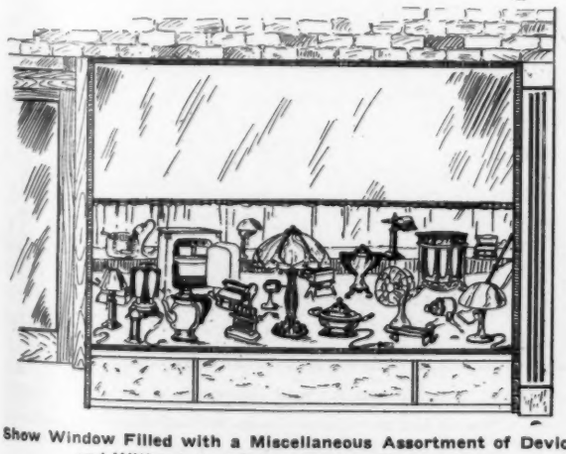
But looking at it from all angles, it certainly seems that the conditions surrounding high-pressure business of the kind which comes during the holidays, when special arrangements as to stock and sales force have to be made to take care of the demand, justify a longer margin to work on than is usually needed.

Has Competition Bluffed You?

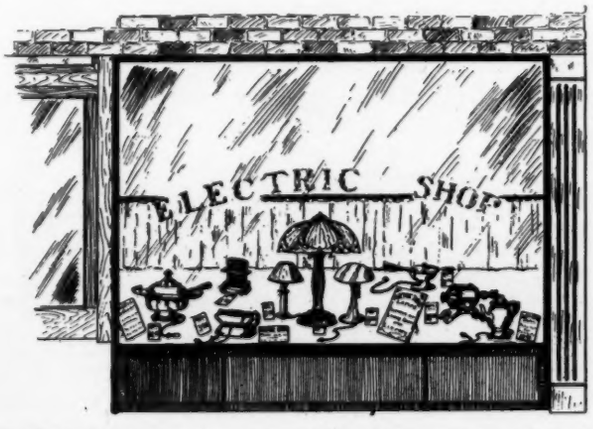
An electrical concern which is making a strong play for retail business just now seldom or never prices the goods which it displays in its windows. The writer was sufficiently interested to ask why.

"Well," confessed the sales manager, "we carry a higher-priced line than most of our competitors, including the department stores, which are not so very far away, and if we put our prices in the display it would make people think that our goods sold for a good deal more, in proportion, than those of other stores. So we just display the goods and wait until prospective customers come in to quote a price."

Yet this manager went on to say, in almost the same breath, that many people come into his store with cheap electric irons and other appliances which have been bought at supposedly bargain prices, asking for repairs, owing to the trouble which they have experienced. In other words, he has the best kind



Show Window Filled with a Miscellaneous Assortment of Devices and Without Any Price Cards or Explanations.



A Display of Electrical Devices with Attractive Price Cards for Each Appliance.

of "reason-why" story to tell to the public on the subject of prices, if necessary to tell it.

Instead of being afraid to quote a price higher than is offered elsewhere, the merchant who is selling a quality article at a correspondingly high price can afford to put the loud

Ticket Office of a Motion-Picture Theater Showing an Electric Heater Installed. There is a Vast Field for This Class of Business.

pedal on that feature. He can even make an argument out of having the highest instead of the lowest-priced goods, if he can back up the statement with proof of top-notch quality.

The chances are that if this dealer put a card in his window, along with an electric iron display, announcing, "This is the Highest Priced Electric Iron Made. Come in and Let Us Demonstrate Its Superiority," he would hear from a lot of people who may have been deterred from buying because of the idea that they would have trouble if they bought a cheap iron.

Then again, it is worth remembering that many of the patrons of the electrical stores are men, while most of those who deal with the department stores are women. Women are willing to go from one store to another in search of the lowest price, but men value their time too much to do that. Few men are acquainted with prices in lines outside of their own business, and hence the dealer can usually quote a price without even risking a mental comparison on the part of the passerby with the figures offered by some other concern. In short, the competitive element is usually figured at much greater importance than its real value in the sales situation warrants.

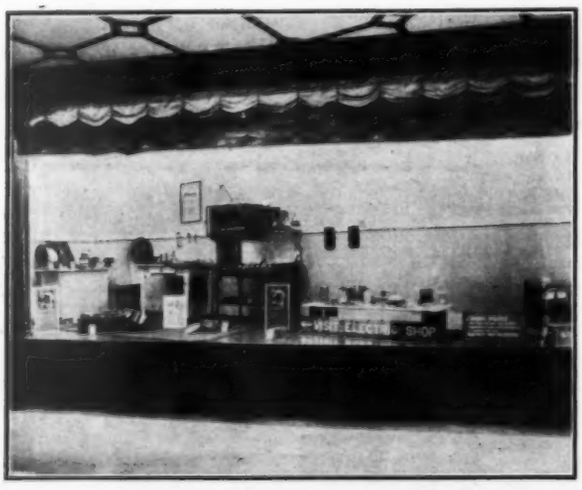
Then, too, the dealer who doesn't quote a price loses a lot of the sales which are made "out of the window." If a man sees an electrical appliance that interests him, he is likely to come in and buy if he knows what it is going to cost. But he doesn't want to risk bumping into a figure higher than he can afford, and in the absence of that information he doesn't act at all. The matter of pricing merchandise displayed in the windows is important, and it looks as if the dealer who leaves off this information is failing to complete the story that must be told about the goods in order to get business.

The Motion-Picture Field.

Most of the motion-picture theaters have their ticket stands in the front of the lobbies, some distance from the auditoriums. It is not customary to connect the steam-heating system with these stands, as there is hardly room for a radiator, and as there must be an opening for the sale of tickets the chances for discomfort on the part of the beautiful lady usually engaged in this operation are good—unless special provisions are made to take care of her. It is noticeable that many of the theaters are purchasing electrical heaters for this purpose, and the chance to sell them, if they have not already been obtained, is just about 100 per cent. The dealer who would make a canvass of this field in his locality right now would get business.

Electric-Lighting Plant to Be Provided by Liquor Tax.—The municipality of Azogues, Ecuador, will install an electric-lighting plant in that city. The funds required for the installation are provided by a special tax on the liquor brought into the district of Azogues, and on that now held there, in addition to a tax on rural distillation. Other revenues, including a small tax on the sale of foreign merchandise, will complete the resources. Upon the installation of the electric plant, the revenues used for this purpose will be diverted to drainage and paving work in the city of Azogues.

NOTABLE THANKSGIVING WINDOW DISPLAYS



The importance of timeliness in window displays is thoroughly appreciated by the Commonwealth Edison Company, of Chicago, and an effort is always made by this company to tie in its displays with some seasonable or civic movement. During the week before Thanksgiving the window dress shown in the above illustrations was used. Two adjacent windows were employed, one showing a model, electrically equipped kitchen and the other an attractive dining room, all set for the holiday feast and with the modern electrical conveniences shown ready for use.

BOOK REVIEWS

"The American Boy's Book of Electricity." By Charles H. Seaver. Philadelphia: David McKay. Cloth, 365 pages (5⅝ x8¾ inches), illustrated. Supplied by Electrical Review Publishing Company, Inc., for $1.50.

This is a book of elementary experimental electricity for young boys. Its aim is to encourage boys to gain an early first-hand acquaintance with electrical phenomena and chiefly through homemade apparatus, thus developing both the power of observation and training of the hand. This general aim is quite well carried out. The interest of the boy is further stimulated by brief historical references to the principal developments in magnetism and electricity and by condensed explanations of the principal phenomena. The experiments are almost exclusively of a simple character, requiring only easily made apparatus. After the more elementary chapters on magnetism, static electricity, batteries, electric circuits and electromagnets, there are chapters on electrical applications, such as electric heat, light, generators, motors, telegraph, telephone and wireless telegraphy; the concluding chapters deal with house wiring, rural electric plants, gas engine and automobile electricity, making and installing of simple fixtures.

The directions given for the building of apparatus are intended to produce means not merely for demonstrating the fundamental principles but also the more simple applications of electricity, considerable ingenuity being shown in the construction of much of the equipment, which though crude is effective for the purpose. Considerable space is devoted to wireless experiments. The chapters on house wiring and fixture installation should better have been left out. Even though numerous precautions are pointed out in this connection, the subject of house wiring is too important and responsible a matter to be left to the amateur electrician. Moreover, it hardly has place in a book that deals primarily with experimental electricity. In this sphere the book is of undoubted value in stimulating ingenuity and constructive skill, while giving the boy an interesting introduction to the fascinating realm of electricity.

"Central Station Management." By H. C. Cushing, Jr., and Newton Harrison. New York: D. Van Nostrand Company. Cloth, 397 pages (5x7½ inches). Supplied by Electrical Review Publishing Company, Inc., for $2.00.

The preface of this book states that its purpose is to set forth clearly and simply the principles that are adopted by the successful electric light and power stations of the United States. The aim has been well conceived, but poorly executed. The material has been tolerably well selected, but poorly arranged and execrably written. Except where quotations are made, the English is poor, the meaning elusive, and the style anything but clear. The arrangement is not orderly, as evidenced by the repetition in Chapter XXI of a table and a page quotation from an English authority already given in previous chapters. The impression given is that a collection of miscellaneous writings has been made, one of which bears internal evidence of originating several years before publication, yet the statement that an event occurred "last week" is permitted to stand. This is but one example of poor proofreading (or entire lack of it) which is noticeable in many places. Others are the statement of 1,400 cubic inches as the volume of a kitchen in which some tests were carried out, and the insertion (page 52) of nearly a page of type referring to storage batteries (apparently from some other book) into a discussion of costs. The status of electric heating and cooking is deduced from articles several years old, and industrial electric heating is not listed among the sources of revenue of a central station. In discussing financial matters a clear distinction between outlays for capital purposes and for operation is not made.

There are 32 chapters in the book. The first is introductory and is followed by three dealing with costs and related matters. Two are devoted to regulation by commissions. Two chapters are concerned with getting new business and five with rates. One chapter discusses prepayment for current and one bills for lighting. Six chapters are devoted to electric lighting, and a seventh is entitled "Accidents Due to Bad Lighting," three of the thirteen pages referring to this subject. Electric cooking takes one chapter. A chapter on farming by central-station power is sandwiched between one on district heating and six others on boiler practice. The final chapter on "Electrical Injuries" is a good treatment of the subject by Dr. C. A. Lauffer. The lack of an index is not felt, as the subject matter is well covered in the table of contents.

In spite of many shortcomings, the book contains much of value for central-station managers who have not kept in touch with the proceedings of the National Electric Light Association and kindred publications. If a second edition could be prepared in which a more logical arrangement was followed, and the same material rewritten in good, clear English, with a fuller presentation of the principles which have been established by regulatory commissions, we might expect a volume which every central station would want to possess.

"Electrical Tables and Engineering Data." By Henry C. Horstmann and Victor H. Tousley. Chicago: Frederick J. Drake and Company. Cloth, 331 pages (4x6½ inches), 34 illustrations. Supplied by Electrical Review Publishing Company, Inc., for $1.00.

This volume is not only a valuable collection of tables and data, but an encyclopedic collection of many related matters of information. The terms are arranged in aphabetical order, and many of the subjects are discussed to a length hardly to be expected in a book of tables. This statement applies to such subjects as electric signs and motors. The tables are not confined to purely electrical matters, but include such mechanical data as belts and screws, and a few mathematical tables such as reciprocals and five-place logarithms. Most of the material is up to date, but incandescent lamps are listed under the triple voltage rating, which has been abandoned by the manufacturers. Electric cooking is treated very scantily, no information being given on wiring requirements, as is done under many other headings. The statement as to expense of electric cooking is apparently based on Chicago conditions, and would not apply to some parts of the country. Taken as a whole, the compilation is a very useful one, and may perhaps be ranked as the best which has appeared from the prolific pens of these well-known authors.

"Electric Motors, Direct and Alternating." By David Penn Moreton. Chicago: Fredrick J. Drake and Company. Cloth, 241 pages (4x6½ inches), 115 illustrations. Supplied by Electrical Review Publishing Company, Inc. for $1.00.

The sub-title of this volume states that it deals with principles, construction, operation and maintenance, and is a practical book for the practical man. The theory of motors is not gone much into, and the text is largely descriptive. The first three chapters treat of fundamental electric and magnetic principles and relations, and the fourth of electrical measurements. The following four chapters deal with direct-current motors and the last four with alternating-current motors. In each case one chapter is devoted to armature winding, one to speed control and characteristics, one to commercial types, and one to care and troubles. The latter will prove especially useful to the practical man who is concerned with keeping motor equipment in good running order. Numerical examples are given to illustrate the use of some of the formulas. The book constitutes a very concise presentation of the important facts regarding motors and as such will be in demand by those needing information on this practical and increasingly important subject.

NEW APPLIANCES

A Weekly Review of the Latest Developments and Current Information Respecting Electrical and Kindred Mechanical Appliances

UNUSUAL DEVELOPMENT OF MOLDED INSULATION.

Electrose Now Adopted as Standard in United States Army and Navy.

The history of the development of the transmission of electrical energy at high voltages shows that one of the most serious obstacles encountered was to secure insulation that would withstand the voltages proposed. That is, the development of generating and transforming apparatus progressed faster at one time than the development of insulators and insulating material. This fact led to improvements in the design of insulators and in methods of securing them to supports, followed by the discovery of insulating compounds possessing sufficient electrical and mechanical strength, unaffected by temperature changes and impervious to moisture. This progres in the development of insulation has made possible commercial transmission at 150,000 volts, with 250,000 volts as the probable maximum.

One of the pioneers in the development of high-tension insulation is Louis Steinberger, president and general manager of the Electrose Manufacturing Company, Brooklyn, N. Y., who was one of the first to make successfully and on a commercial basis high-potential insulators from a compound. This material, known as Electrose, was discovered and placed on the market about 24 years ago and since that time played an important part in transmission line construction. It was found to be well adapted for use on high-potential circuits, withstanding arcing without destruction, possession great strength, hardness and toughness, and taking a smooth polish which renders it water and oil proof; it will not warp or shrink under ordinary conditions, and the flexibility of the material permits it to withstand severe heat expansion strains, certain grades being suitable for use under 300 degrees Fahrenheit. These qualities, proven by numerous tests, recommended it in 1902 to the Canadian Niagara Power Company and the Niagara Falls Power Company for use on their transmission lines, where it has given extremely satisfactory service.

Electrose is well adapted for combination with metal parts, which may be molded into it in a firm manner and which are not corroded by the combination. This, together with the fact that it is easily worked, has resulted in the development of numerous applications of the material for insulating purposes and of an extensive line of insulators by the Electrose Manufacturing Company in accordance with Mr. Steinberger's numerous patents in this highly specialized field.

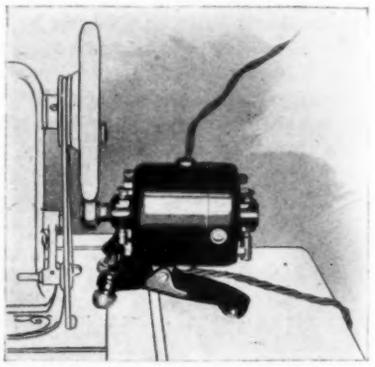
Possessing, as it does, permanency of form, Electrose is particularly suitable for insulating parts that require accuracy and permanence of dimensions. This is borne out by its wide use in connection with insulating parts for telephone apparatus, for ignition service for automobiles, aeroplanes, etc., and for radiotelegraphic apparatus. Its ability to withstand high-frequency currents in radio work has recommended it to the United States Government and commercial wireless telegraph and telephone companies, who have adopted it as standard insulation for this work.

While the discovery and development of Electrose has been instrumental in the extension of high-voltage transmission line possibilities, the worth of its various other applications cannot be discounted, for its wide and satisfactory usage proves it to be a valuable adjunct to the list of electrical materials.

Menominee Universal-Type Sewing-Machine Motor.

A great many housewives would make more use of sewing machines, if the operation of such machines for any extended period were not so arduous and particularly "back breaking." To overcome this a number of electric motors that can readily be applied to almost any sewing machine have been placed on the market, of which the one illustrated herewith is a new type especially designed for this purpose.

This motor is a very small and light-weight but powerful machine. It has an adjustable base with rubber-tipped feet. The shaft of the motor carries a small friction pulley. To



Menominee Motor Applied to Sewing Machine.

apply the motor to the machine it is necessary merely to remove the belt and place the small friction pulley of the motor against the handwheel that usually is found at the right end of the sewing-machine head. In order to have the little pulley bear against this wheel properly, slight adjustment of the motor base may be required, but this can be fixed in a moment. The rubber tips on the base prevent the motor from slipping and from scratching the polished surface. No clamps or screws are necessary to secure the motor to the machine.

For controlling the motor, a foot-controlled rheostat is provided which is arranged for four control steps. To start the motor requires merely pressing on the pedal, the amount of pressure determining the speed that the motor attains. The motor and rheostat are permanently connected by a substantial cord, so all that is necessary to use the motor is to connect the extension of this cord from the motor to any ordinary 110-volt lighting outlet.

The motor is of the popular interchangeable or universal type and operates on either direct-current or alternating-current circuits. It is substantially built and neatly finished. It is manufactured by the Menominee Electric Manufacturing Company, Menominee, Mich., and sold at a comparatively low price in view of its excellent construction.

Chelten Standard Automobile Fuses.

The many uses of electricity on the up-to-date automobile have required the development of reliable fuses for insertion in the various circuits on the car. Such fuses have been standardized through specifications of the Society of Automobile Engineers. A full assortment of the standard automobile fuses is now being placed on the market by the Chelten Elec-

Assortment of Ten Types of Chelten Automobile Fuses.

tric Company, 314 Armat Street, Philadelphia, Pa. They are all of ferrule-cartridge or inclosed type and are built with as much care as National Electrical Code fuses that are standard for light, heat and power circuits of standard voltages.

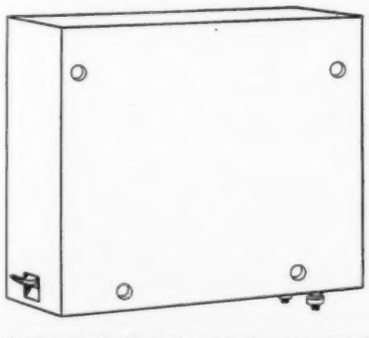
Each fuse is carefully calibrated to conform strictly with the specifications of the Society of Automobile Engineers. They carry a 10 per cent overload indefinitely; at 25 per cent overload they blow without overheating; at 50 per cent overload they open the circuit promptly. The fuses are made with glass or fiber tubing and in ten different current capacities from 3 to 30 amperes. Six type numbers are made, depending on the dimensions.

These fuses are shipped in standard packages of 100, either all of one kind or of assorted sizes. One of these assorted cartons is shown in the accompanying illustration. The Chelten company has found from experience which fuses are used most extensively and in the assorted carton includes a fuse for every car with more of those used most.

Electric Furnace-Draft Operator.

The approach of very cold weather is causing every householder to put into as good condition as possible every detail connected with the operation of his house-heating plant. By this means and by the use of labor-saving and coal-saving methods, he is enabled to operate the plant conveniently and economically throughout the winter.

It is the usual practice to maintain a lower degree of heat during the night than during the day. This requires a hot fire for a certain time in the early morning to bring the temperature of the rooms to the comfortable point desired by day. To provide for this hot fire a very simple electrical draft operator has been placed on the market. It consists of a compact box containing an electromagnetic trip that is arranged to release a hook on which is supported a five-pound weight attached to a chain connected with the main and check-draft dampers. A push button installed at any convenient point, as at the side of the owner's bed, is connected to the operator's box through ordinary bell wires with a couple of dry cells in series. The same cells or bell-ringing transformer used for the door bells may be connected into the circuit.



Electromagnetic Operator for Furnace Drafts.

In the morning when it is desired to put the furnace under full draft, it is necessary merely to press the button (without going down to the cellar) which releases the weight, opens the main draft and closes the check draft. When the owner is ready to arise he finds the house warm and comfortable and can replenish the fire at his leisure.

The outfit can be easily installed for any type of hot-air furnace, steam or hot-water boiler. It is low in first cost and economical in operation and is patented. It is manufactured and sold by Walter Hann, Hasbrouck Heights, N. J.

New Machine-Tool Starting and Regulating Controller.

In addition to its new automatic-type machine-tool controllers the Cutler-Hammer Manufacturing Company, of Mil-

C-H Machine-Tool Controller for Starting and Regulating Duty.

waukee, Wis., has developed a new compact type of drum controller made in standard sizes for direct-current motors of 1 to 25 horsepower. These controllers provide speed regulation by inserting resistance in the shunt-field circuit, the armature resistance being designed for starting duty only. The maximum speed range that can be provided is 3 to 1.

The armature contact fingers and segments are of solid copper, easily renewable, and are so arranged that dynamic braking is provided when the drum is returned to the off position. The field-regulating unit consists of a field-resistance commutator mounted on the drum shaft and the necessary field resistance in the form of ferrule-type units located in a ventilated case at the end of the drum. They are connected to the commutator through contact clips at each end so as to eliminate all lead wires.

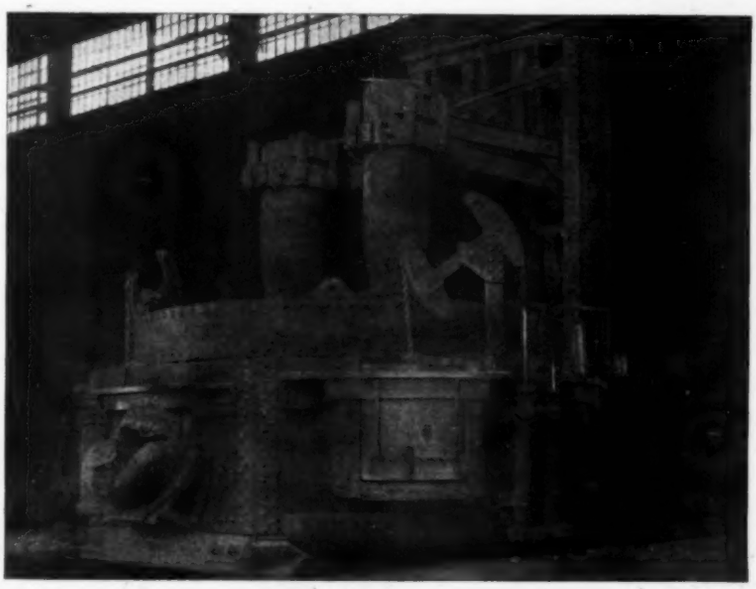
Gear or sprocket drive may easily be employed in place of the handle to bring the control to a convenient point as, for instance, the apron of a lathe. Protective panels when furnished are mounted upon the frame containing the armature starting resistance.

ELECTRIC FURNACE EQUIPMENT FOR THE IRON AND STEEL INDUSTRY.

Westinghouse Electrical Apparatus for Arc Furnaces.

The commercial field of the electric furnace is broadening considerably, due to the perfecting of furnace design and the reduction in cost of power. Formerly, electric furnaces were used in the steel industry principally for the refining of high-grade alloy and tool steel. Now they are being used more widely for the refining of common grades of steel. This is made possible by the reduction in power costs, and the improvements that have been made in blast-furnace design and the method of operating the furnace. In steel foundries, the electric furnace is being used largely for melting, though a limited amount of refining is done.

The electric furnace of today differs greatly from the older types; costs have been lowered by the use of larger furnaces, improved devices for charging and tilting, larger electrodes, and automatic regulation, all tending to greater economy. Several different types of furnaces are in use. These are of three general classes, the induction, the resistance and the arc types. The latter, in sizes from one-half to 20 tons is used almost exclusively in this country in steel works.



Six-Ton Electric Arc Furnace for the Melting and Refining of Steel.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which has been closely associated with the development of the electric furance, has developed complete electrical equipments for all classes of electric furnaces. These include, for the arc type of furnaces, assuming high-tension alternating current is available, the following apparatus: line protective equipment, switchboard, step-down transformers, furnace-tilting motors, motors for adjusting position of electrodes, and a regulating system for the control of the electrode motors.

Protective Equipment.—The protective equipment includes suitable lightning arresters, choke coils, disconnecting switches, and main-line circuit-breakers, the latter usually electrically operated and controlled from the furnace room.

Switchboard.—The switchboard usually has mounted on it a voltmeter, power-factor meter, three indicating wattmeters or three ammeters, a graphic recording meter, and a watt-hour meter. Where direct current is not available for the electrode motors, a motor-generator with the necessary control panel is also required.

Transformers.—Transformers are required to reduce the supply voltage to a potential suitable for the furnace. The company's many years of experience in building large transformers for furnace as well as for general power service has resulted in a unit particularly well adapted for this work. Oil-insulated transformers can be supplied in either self-cooled or water-cooled types, in all capacities and voltages, and for frequencies of 25 to 60 cycles, single, two or three phase.

Tilting Motors.—On all large electric furnaces of the tilting type, the tilting mechanism is operated by a motor. Either alternating or direct-current motors with characteristics similar to those used for hoisting work are suitable for this service. The controller is of the reversing type and a motor brake is used to prevent overtravel of the furnace and hold it in any desired position. For this service the company has a complete line of both alternating and direct-current tilting motors, ranging from 15 to 150 horsepower, together with suitable controllers and brakes.

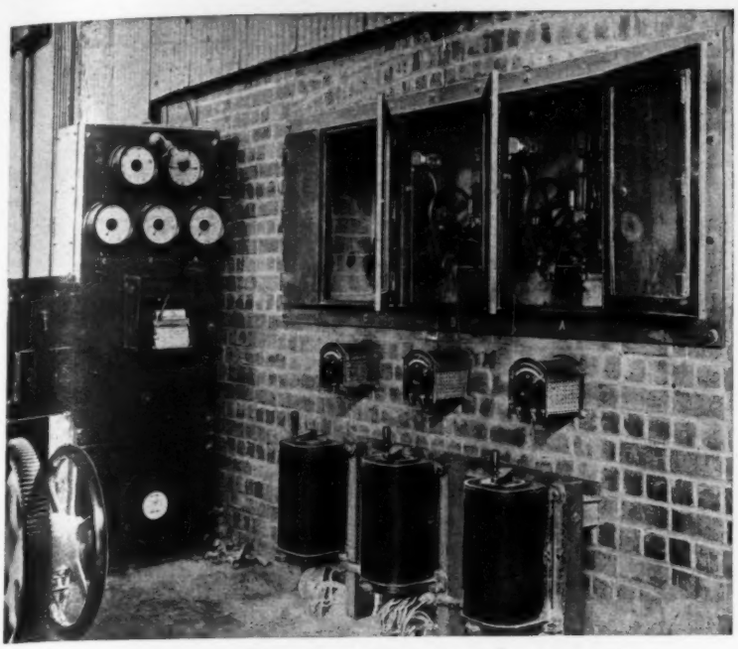
Where automatic control of the electrodes is desired, a motor-operated hoisting mechanism is provided for each electrode. As the motors are mounted on the furnace which tilts, the bearings are built with special lubricating features. Shunt-wound, direct-current motors are selected for this service, as a much simpler and more positive system of control can be provided than for alternating-current motors. Usually, the motors are totally inclosed, their horsepower and speed depending upon the size and type of furnace.

Thury Automatic Regulating System.—One of the greatest improvements made in the modern furnace is the feature of automatic regulation of the current. The object of the regulating system is automatically to maintain a constant current at the furnace. Among the advantages of automatic regulation are: large saving in labor charges, more efficient utilization of the current, and reduction in the time required, thus resulting in maximum production and efficiency; and, due to the more stable furnace conditions, the product is of a higher and more uniform quality. These improved conditions are obtained by means of the Thury regulator.

The Thury system is used on a large percentage of the electric furnaces now installed. It can be used with any arc furnace to maintain a constant current which can be adjusted through a wide range. It can also be adapted for maintaining a constant potential when desired. The equipment for the automatic control of a three-phase furnace consists of three regulating equipments, including wall brackets, one countershaft complete with pulleys and bearings, one motor to drive countershaft, three regulating drum controllers, three field regulators, three resistances, and two series transformers.

Damping devices permit the regulator to act only when necessary. Sudden changes and peaks of short duration will not put the regulator in action. This in itself is very important, as there is not only a great saving in the wear and tear of the electrode-hoisting mechanism, motors for driving same, etc., but the current is kept more uniform by avoiding unnecessary regulation.

Each regulator controls one electrode. The regulator is controlled by a solenoid energized by means of current from series transformers in the main high-tension circuit. The regulator in turn controls the armature circuit of the electrode motor to give it motion in either direction, or

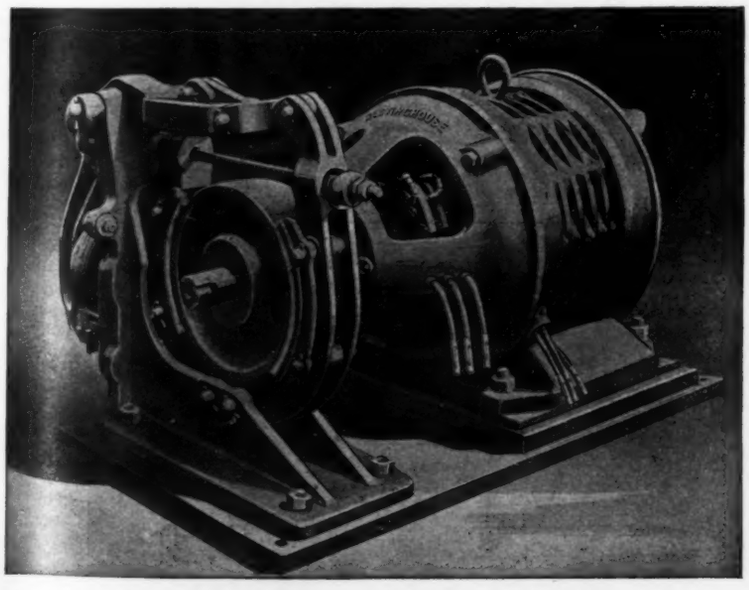


Thury Regulating Equipment for Electrode Control of a Heroult Furnace.

stop it, as required. This electrode motor operates a hoisting mechanism, which in turn raises or lowers the electrode. The regulator can handle any amount of power for regulating purposes without impeding the free play of the controlling mechanism, which is only in contact with the power mechanism for exceedingly short periods of time and is otherwise perfectly free. Intermittent action of a contact-making arm prevents the regulation from being carried too far in one direction. Thus a high load power-factor and a uniform current on the furnace is assured at all times.

Scherzer Electric Lift Span.

The Keadby Bridge, over the River Trent, in England, which is the heaviest lifting bridge yet constructed in Europe, has a lifting span on the Scherzer principle. This span is worked electrically by means of two 115-horsepower direct-current motors, carried on the lift itself, the power being transmitted through trains of gearing to the main pinions on each side. The angle of maximum elevation of the bridge when fully open is 81.5 degrees and the time taken to open or close it by electrical power is less than two minutes. The generating plant consists of two directly coupled 50-kilowatt gasoline continuous-current sets (220 volts). A large storage battery is provided, capable of supplying the motors with current for about thirty operations of the bridge without recharging. Two sets of electric brakes are provided and at the fore end of the span two heavy forged steel bolts, worked electrically from the control cabin, engage with castings anchored down to the pier, so locking the bridge when in the "down" position. Electrically operated gates are provided for the protection of roadway traffic, which are interlocked with the railway signals. The latter are what are known as three-position signals and are the first to be installed as a complete scheme in England.



Alternating-Current Motor for Furnace Tilting, with Solenoid-Operated Drag to Prevent Overtravel of the Furnace.

Electric Drive for Ships.

The electrical propulsion of vessels has been attracting attention in Sweden, and experiments with the *Mjolner,* a small craft built over a year ago, seem to have yielded remarkably good results. The initial energy is generated by two 400-kilowatt turbo-alternators. The turbines run at 2,700 revolutions per minute, and the three-phase alternators deliver current at 500 volts. Both squirrel-cage and slip-ring motors are employed. The former are much more convenient in working, but the latter have the advantage that a resistance may be introduced into the rotor circuit to give speed control. A somewhat novel arrangement is the use of mechanical gearing between motors and propeller, the latter being driven at 90 revolutions per minute by motors running normally at 900 revolutions per minute.

In a trial run of three hours, with boiler pressure of about 230 pounds per square inch, the performance is reported to have been 35 per cent superior in fuel economy to that of a sister ship using reciprocating engines.

New Insulating Material.

A material especially suitable for switchboards, panelboards, barriers, insulated walks and the like, where a moisture-proof substance of high electrical resistance is required, is "Lin-Stun," which is a natural stone that after impregnation with an insulating compound is rendered a homogeneous material entirely nonabsorbent of moisture. Its electric strength becomes so greatly increased that a board of one inch in thickness will not puncture under 125,000 volts.

This material has been approved by the Underwriters' Laboratories, and has successfully met tests made by many electrical manufacturers. It is manufactured in all commercial sizes and thicknesses and in several colors (especially in perfectly dull black) by the Lin-Stun Company, 5010 Gloster Street, Pittsburgh, Pa. It is expected to be much used as a substitute for slate.

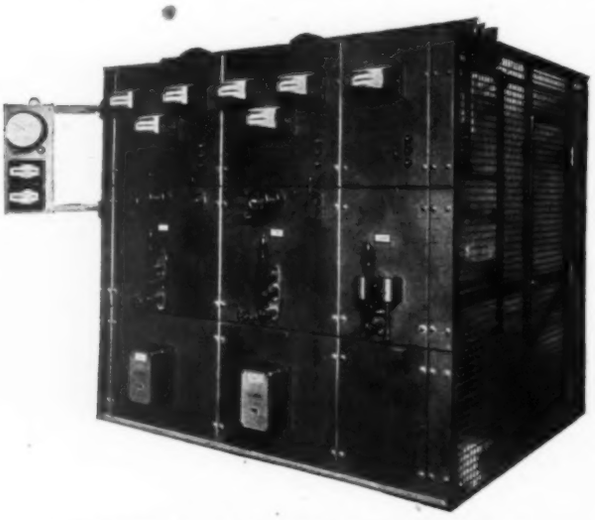
"Safety First" in Switchboard Construction.

Probably in no phase of industrial activity has the "Safety First" propaganda a more direct application than it has to the electrical industry. Close co-operation between the manufacturers and the large users of electrical machinery has resulted in the development of many devices to safeguard life and property.

A recent development of importance along this line is the switchboard shown in the accompanying illustration which embodies several desirable features of safety and convenience. All live parts, except current and potential receptacles, are inaccessible from the front of the board and the live parts of these receptacles are recessed so that accidental contact with them is difficult.

Grillwork screens afford protection against accidental contact with live parts in the rear of the board. Hinged doors provided with spring locks are placed one on each side of the grillwork, making it impossible for any one, other than an authorized person holding the key, to enter the space at the rear of the switchboard.

Disconnecting switches are used between all oil circuit-breakers and busbars and provide convenient and rapid isolation of the breakers from the bus for inspection, changing oil or repairs, without hazard. Instead of the usual calibrating switches back of the panel, this board is



Dead-Front 2,300-Volt, Three-Phase Switchboard.

equipped with front-of-board calibrating receptacles which permit safe and convenient calibration of instruments and meters from the front. Insertion of plugs in the calibrating receptacle connects the testing instrument in series with or directly across the instrument under test, as may be required for ammeters, voltmeters, etc. The board is also equipped with removable fuse receptacles of the screw-plug type which provide for a replacement of potential-transformer-secondary fuses from the front of the switchboard without danger of contact with live parts.

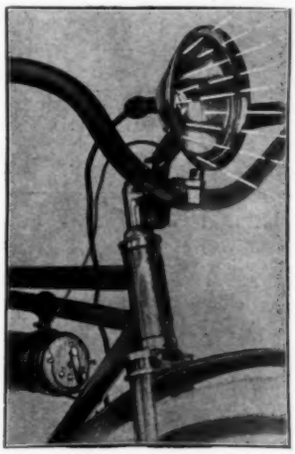
The live parts of the field switches are mounted on slate bases back of the panel and are connected to operating handles on the front of the board by rods and bell cranks. This method of mounting field switches is a development of importance and is strongly recommended, as it is impossible for the switchboard attendant to be injured by the arc or to come in contact with live parts of the switch when operating. Instruments and other adjacent equipment are likewise safe from damage by burning which sometimes happens with the front-of-board type of field switch.

When switches are required for arc or incandescent circuits, the switches are of the dead-front plug type. All live parts are back of the panels and cannot be touched from the front. This result is obtained by using two tubular receptacles and a two-point double-break switch plug per pole. The entrance bushings for receptacles are of molded material and extra large in size.

The panels described are for general power and lighting service up to 3,500 volts, 25 to 60 cycles, and are manufactured by the General Electric Company, Schenectady, N. Y.

Double-Filament Lamp for Bicycle Headlights.

The headlight of a bicycle or motorcycle, just as that of an automobile, must provide for two services: First, on fairly lighted streets it must warn pedestrians and drivers of other vehicles of its approach. Second, on unlighted or poorly lighted streets and country roads it must illuminate the road-

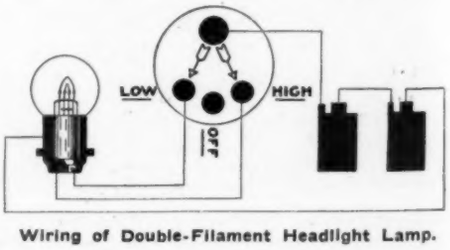


Double-Filament Lamp in Bicycle Headlight.

way ahead to prevent running into ruts, ditches, etc. These two services have different requirements, in the first case a relatively low-powered glare-free lamp suffices, while in the second quite a powerful light source is required. In the case of electric headlights various schemes have been made use of to obtain the two degrees of lighting, such as use of two independent lamps in each headlight, series-parallel switching of single lamps in the two headlights, and use of resistance in series with the lamp.

To overcome the disadvantages of these schemes, a double-filament lamp has been placed on the market by the A. C. Mannweiler Company, Incorporated, 2721 Broadway, Fort Wayne, Ind. It is designed especially for the headlights of bicycles and motorcycles and is operated from two dry cells, which evidently require the highest possible efficiency in the lamps.

The new lamp operates on the high-low principle. Its two filaments are controlled by a three-way switch, as shown in the accompanying illustration. By turning to the high point the lamp produces two candlepower; by turning to the low point the lamp produces one-half candlepower. The object is to operate on the smaller filament except when a very powerful light is needed. The battery thus gives practically four times the service rendered by the regular battery for this purpose, at the same time providing just the light that is needed.



Wiring of Double-Filament Headlight Lamp.

INDUSTRY ACTIVITIES

Crouse-Hinds Company, Syracuse, N. Y., has issued Bulletin No. 301, description of its types SDA and SDX Imperial flood-lighting projectors.

C. H. Sharp Manufacturing Company, Los Angeles, Cal., has prepared leaflets descriptive of its "Hot-en-tot" midget electric heater, which has a capacity of six amperes at 110 volts, and is designed for quickly heating small rooms, offices, etc. The company has also prepared descriptive circulars for use by the trade.

General Electric Company has broken ground for a $500,000 plant for the Providence Base Works, containing more than 200,000 square feet of floor space. The plant will be given over entirely to the manufacture of brass bases for electric light bulbs, and will be the principal factory of the company for this type of work.

National Tube Company, Pittsburgh, Pa., has prepared a series of motion pictures entitled "The Manufacture of National Pipe from Ore to the Finished Product," which is being exhibited before various engineering organizations. The pictures show the mining of the ore, transportation of the ore, blast-furnace processes, and operations in the manufacture of the pipe.

Lux Manufacturing Company, Hoboken, N. J., has been licensed, under date of November 1, by the General Electric Company, to manufacture Lux lamps under all the General Electric incandescent lamp patents. The former company, having arranged payment of certain royalties to the General Electric Company on past and present production of Lux lamps, thereby fully protects all distributors, dealers and consumers in the use and sale of its product. The Lux company is constantly improving the quality of Lux lamps, and through this arrangement expects to attain a quality second to none.

Acme Wire Company, New Haven, Conn., manufacturer of magnet wire, field coils, solenoids, electromagnets, etc., has increased its capital stock from $500,000 to $1,000,000 to provide facilities for handling its rapidly increasing business. The membership of the board of directors was increased from six to ten. The officers of the company are: Victor Morris Tyler, president and treasurer; Edgar L. Hartpense, vice-president and general manager; L. S. Homer, vice-president and sales manager; Leonard S. Tyler, vice-president and production manager; Bower Hewitt, assistant treasurer, and James E. Wheeler, secretary. The Acme company was organized in 1904 and is one of the largest manufacturers of magnet wire and coils in the country.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued Leaflet 1660, on automatic starters for squirrel-cage induction motors; Leaflet 3814, on types CO overload and CR reverse-power alternating-current relays; Leaflet 3949, on types EW and ET direct-current automobile meters; Leaflet 3950, on type PW portable direct-current meters for testing purposes; additions to Catalog 3001, on general characteristics of oil circuit-breakers, feeder control pedestals, type C direct-current relay switches, type CA hand or electrically operated carbon circuit-breakers for direct or alternating-current circuits. The Westinghouse company has also issued a 75-page booklet descriptive of the maintenance of equipment in the Harvard shops of the Cleveland Railway Company. The arrangement of the shop buildings and equipment, as well as many of the operations involved in the maintenance of street cars, is described in detail.

The Chelten Electric Company, 314 Armat Street, Philadelphia, Pa., manufacturer of electrical specialties, has recently purchased a large tract of land on which it will erect a five-story fireproof factory building, with a floor space of about 50,000 square feet. The new building will serve to take care of the company's rapidly increasing business, and when it is ready for occupancy, which will be during the fall of 1917, the company intends to make extensive additions to its line of house-wiring and lighting specialties.

American International Corporation, 120 Broadway, New York City, of which Charles A. Stone, of Stone & Webster, is president, has submitted a preliminary report to its stockholders. The corporation was organized in November, 1915, with a capital of $50,000,000, for the purpose of investigating, appraising, financing and managing enterprises in foreign countries. To date over 1,200 propositions have been submitted to the corporation for consideration, which include a great number from South America, Europe and other countries, involving in some instances, the construction of waterworks, sewage and electric systems. Besides Mr. Stone, others prominent in the electrical field associated with the corporation are: Guy E. Tripp, of the Westinghouse Electric & Manufacturing Company; Theodore N. Vail, of the American Telephone & Telegraph Company, and Edwin S. Webster, of Stone & Webster.

Paducah Pole & Timber Company, Paducah, Ky., has completed arrangements for securing a large tract of cypress stumpage land and will manufacture cypress crossarms. The company has completed the installation of a factory in Bondurant, Ky., with a capacity of 5,000 10-foot crossarms per day. John L. Fay, sales manager, recently made an analysis of the characteristics of the different woods available for crossarm purposes, and in advocating the use of cypress, states that it is recognized as one of the most durable woods known. It possesses small capillary tubes, which give it a fine-grained structure, affording exceptional strength. The cellular structure and fine grain is well adapted to receive treatment, the size and form of the cells being such that treatment is retained in such a way that the preservative does not leach out rapidly, as is the case when the cellular structure is large. Cypress has not been generally used for crossarms because the demand for this wood for building has been great.

The Precision Die Casting Company, Incorporated, Syracuse, N. Y., has been formed by the purchase from Charles Van Wagner of the entire business of the Van Wagner Die Casting Corporation (formerly the E. B. Wagner Manufacturing Company) and the Precision Die Casting Company. The merger brings to the business a new management made up of men already well known in the manufacturing world. Alterations and extensions which will result in improved service to customers and quality in products have already been undertaken and ample capital provided for taking care of increasing business. The officers and directors of the new company are: President, T. G. Meachem, vice-president and general manager of the New Process Gear Corporation; vice-president, J. W. Knapp, treasurer of the Van Wagner Die Casting Corporation; treasurer, H. S. Teney, secretary of the Syracuse Trust Company; secretary, E. J. Quintal, of Farrel, Sehl & Quintal; A. P. Bellinger, of Solvay Process Company; G. W. Bowen, of the G. W. Bowen Manufacturing Company, Auburn, N. Y., and W. A. Ball, of the Semet Solvay Company.

LATEST APPROVED FITTINGS

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association

BUSHINGS.—Peru Electric Company, Peru, Ind.

Porcelain bushings with ⅜-inch thread for sockets and outlet box covers.

"Peru," catalog No. 406-W.

Listed November 7, 1916.

CONDUIT BOXES.—P. & B. Manufacturing Company, 189 Fifth Street, Milwaukee, Wis.

Wattmeter connection boxes, catalog Nos. 5000-5038. Also covers for boxes.

Listed October 19, 1916.

CURRENT TAPS.—General Electric Company, Schenectady, N. Y.

"G. E." multiple type, keyless, 660 watts, 250 volts, catalog No. GE696; series type, keyless, 660 watts, 250 volts, catalog No. GE697.

Listed November 7, 1916.

ELECTRIC CRANES.—Pawling & Harnischfeger Company, Milwaukee, Wis.

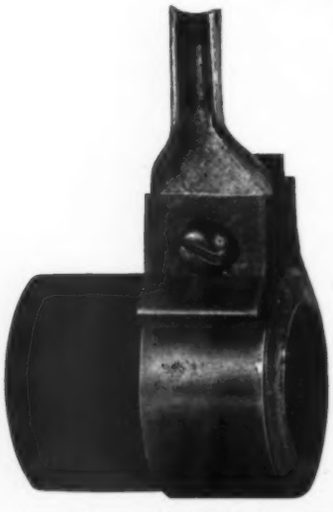
Monorail lumber hoists. Electric traveling hoists for use in lumber yards, sheds and mills. Equipment consists of totally inclosed motors of 20 horsepower or less, brakes and limit switches mounted on hoist frame, and rheostats and faceplate controllers mounted in cab. Wiring in conduit. 125 or 250 volts; capacity, three and five tons.

Listed October 9, 1916.

FIXTURE FITTINGS.—The Cleveland Electric Fittings Company, 906 Society for Savings Building, Cleveland, O.

Fixture crowfoot, made of fine grained cast-iron with set screw and two flat steel springs, for securing one-eighth-inch pipe or chain-fixture stem. "P-U."

Listed September 15, 1916.



Ground Clamp.—Marcus & Company.

GASOLINE-ENGINE ELECTRIC PLANT.—Domestic Engineering Company, Dayton, O.

Non-automatic starting gasoline engine and direct-connected electric generator control apparatus and storage battery for small isolated installations. Electric control automatically stops engine when battery is fully charged.

"Delco-Light." Rating: Generator, 0.75 kilowatts, 32 volts; battery, 80 and 160 ampere-hours. Gasoline capacity limited to one gallon.

Listed November 7, 1916.

GROUND CLAMPS.—Marcus & Company, 135 Pearl Street, Boston, Mass.

"Marcus." Six inches or less.

Listed October 13, 1916.

INSULATING LINKS.—Thomas M. Harrigan, Woodstock, Vt.

Portable insulating link for socket and receptacle chains. When used on pull-chain sockets or receptacles in manner intended, this insulating link is judged to afford to a person operating socket added protection against shock from circuits of voltages of not over 600.

Listed October 5, 1916.

INSULATING MATERIALS.—The Lin-Stun Company, 5010 Gloster Street, Pittsburgh, Pa.

A treated sandstone or limestone for use as a substitute for slate in electrical appliances. "Lin-Stun."

Listed October 13, 1916

OUTLET BUSHINGS.—Butte Engineering & Electric Company, 683 Howard Street, San Francisco, Cal.

Outlet bushings made of two plates of insulating material and a flat steel ring riveted together with openings for wires, one-inch pipe and larger. "B. E. & E. Co."

Listed September 7, 1916.

RECTIFIERS—Hertner Electric & Manufacturing Company, Cleveland, O.

Motor-generator type rectifiers. "Hertner" battery chargers, 11 horsepower and less, with one, two or three-phase motor, 250 volts and less; types L, A-4, A-6, A-8. "Transverter," for use with motion-picture machines, one, two and three-phase circuits, 35, 50 or 75 amperes; types D, D-1, S, S-1.

Listed September 27, 1916.

SWITCH BOXES—Williams Test Clamp Company, 1051 Power Avenue, Cleveland, O.

"Perfection" pressed-steel switch boxes having one removable side and fastenings by which assembly in gangs may be obtained.

Listed August 11, 1916.

SWITCHES, Automatic.—Pawling & Harnischfeger Company, Milwaukee, Wis.

Magnetic switch, 50 horsepower, 220-550 volts; 25 horsepower, 110 volts, type S.

Limit switch, 50 horsepower, 220-550 volts; 25 horsepower, 110 volts, type H.

Listed October 13, 1916.

SWITCHES, Combination Cutout.—The Trumbull Electric Manufacturing Company, Plainville, Conn.

Panel cutouts, with or without copper busbars and lugs, 30 amperes, 125 volts, catalog Nos. 733-38.

Listed November 7, 1916.

SWITCHES, Surface.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"C-H" single-pole, catalog Nos. 7104-5.

Listed November 10, 1916.

TRANSFORMERS. — Independent Electrical Supply Company, 59 Warren Street, New York, N. Y.

Bell-ringing transformers, 110 volts to 6-12-18 volts, catalog Nos. 1, 2.

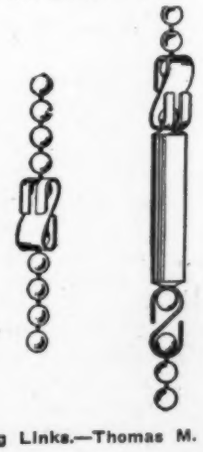
Listed November 14, 1916.

WIRE, Fixture.—Independent Lamp & Wire Company, Incorporated, 1737 Broadway, New York, N. Y.

Stranded conductors, Nos. 14, 16 and 18 B. & S. gauge, having compounded asbestos covering. This wire is furnished as single conductor with or without an outer silk braid and in twisted pair or twin wire with outer silk braid.

Marking: One bleached cotton thread either parallel with wire between compounded asbestos covering and braid, or labeled with copper strands.

Listed November 15, 1916.



Insulating Links.—Thomas M. Harrigan.

PERSONAL AND BIOGRAPHICAL

DR. FRANK B. JEWETT, who, as announced in last week's issue, succeeds MR. C. E. SCRIBNER as chief engineer of the Western Electric Company, is well known to the scientific world, especially in the field of telephony. He was born in Pasadena, Cal., in 1879, and was graduated from Throop Polytechnic Institute of Pasadena, Cal., in 1898 with the degree of A. B., in electrical engineering. From 1898 until June, 1902, he was a student in the University of Chicago, receiving the degree of Ph. D. in 1902. From 1901 until June, 1902, he was research assistant to Professor Michelson of the department of physics. From 1902 to 1904 Dr. Jewett was instructor in physics and electrical engineering at the Massachusetts Institute of Technology. In 1904, Dr. Jewett became connected with the American Telephone & Telegraph Company, and for nearly eight years had charge of transmission development work for the Bell System. While in this position as transmission engineer, the loading of eight-gauge circuits was perfected; phantom cables and phantom loading for open wires and cable were developed, the New York to Denver line and the Boston to Washington underground cable were engineered. Dr. Jewett began work on the transcontinental line, retaining general charge of the transcontinental engineering until the line was completed. In April, 1912, Dr. Jewett became assistant chief engineer of the Western Electric Company, having charge of development and research work. During last October he received complimentary recognition by the National Academy of Sciences in being appointed a member of the committee for the promotion of industrial research, an important part of the National Research Council, which was appointed for the purpose of increasing the use of research in national industries, national defense and similar matters.

F. B. Jewett.

MR. E. H. RAMSBOTHAM, for three years superintendent of the Ohio Service Company's properties at New Philadelphia, O., has been transferred to Hanover, Pa., and will assume general charge of the company's public-utility interests in that city.

MR. R. D. JONES, of Youngstown, O., has been appointed claim agent of the Reading Transit & Light Company, Reading, Pa., succeeding Mr. R. D. BILLINGS, resigned.

MR. TREVOR C. NEILSON, assistant claim adjuster of the Columbus (O.) Railway, Power & Light Company, has been appointed claim agent of the East St. Louis & Suburban Railway and related properties, with headquarters at East St. Louis, Ill.

MR. A. J. VAN BRUNT, director of the Safety Education Bureau of the Public Service Corporation, New Jersey, gave an interesting address on safety, illustrated with motion pictures, to the employees of the company at Jersey City, N. J., on December 7.

MR. J. H. STRUGE, formerly assistant superintendent of the southern division of the Public Service Electric Company, Newark, N. J., has been appointed division superintendent, succeeding MR. PAUL LUPKE, with offices at Trenton. Mr. Lupke will be associated with the company at its Newark headquarters.

MR. WILLIAM G. MEROWIT has been transferred from the Milwaukee factories of the Cutler-Hammer Manufacturing Company to the East, having been appointed representative for the company's line of control apparatus in New York state and in Canada. His headquarters will be at the Cutler-Hammer offices in New York City.

MR. RAYMOND H. SMITH, recently promoted from the position of general manager of the Jackson (Miss.) Light & Traction Company to that of vice-president and general manager of the Sheboygan (Wis.) Electric Company, was presented with a silver loving cup "in grateful recognition of his public services" by the citizens of Jackson just before he left that city. It is an unusual occurrence for the manager of a public-utility company to receive a gift of this kind, but Mr. Smith's activities in Jackson were worthy of such a testimonial. He took charge of the street-railway, electric and gas plants in Jackson four years ago, his work bringing him in contact with practically the entire population of the city. He made numerous improvements to the electric light and power, street-railway and gas service, and when agitation for a municipal electric-lighting plant came up his work in defeating the proposition received much credit from the citizens. Many of the latter signed a protest to the American Public Utilities Company, which manages the properties in Jackson and Sheboygan, against Mr. Smith's removal, but it was not sent because it was decided to be a hindrance to his advancement. Mr. Smith was very active in the Jackson Board of Trade and was president of the Rotary Club. Each member of the Jackson Rotary Club wrote a letter to a member of the Sheboygan Rotary Club in the same business, commending Mr. Smith, who was elected to full membership without the formality of an investigation.

MR. R. J. CORY, who recently was promoted from superintendent to manager of Valparaiso (Ind.) Lighting Company, became identified with the electrical industry in 1907 when he accepted a position with the Western United Gas & Electric Company, Joliet, Ill. After several promotions at Joliet, he was transferred in 1910 to Illinois Valley Gas & Electric Company, Ottawa, Ill. Remaining there a year, he took a position with the DeKalb County Gas Company at Sycamore, Ill., being placed in charge of its distribution system. When this company was purchased by the Northern Illinois Utilities Company, Mr. Cory was transferred to Belvidere, Ill., and given charge of operation and construction work at the local plant. Later he was transferred to DeKalb, and in 1913 became superintendent of the Valparaiso Lighting Company, operated by the American Public Utilities Company, of Grand Rapids, Mich.

R. J. Cory.

MR. VICTOR MORRIS TYLER, president of the Acme Wire Company, New Haven, Conn., which successful organization has recently doubled its capital, making a total of $1,000,000, to take care of its rapidly growing business, is the son of the late Morris F. Tyler, who was interested in the early development of the telephone, and who is most favorably remembered by the leading telephone pioneers of the country. At the time of his death, several years ago, Mr. Tyler was treasurer of Yale University.

OBITUARY.

MR. WILLIAM HATTEROTH, an associate of Alexander Graham Bell in the latter's early experiments with the telephone, died December 7 at his home in San Francisco, Cal. He was born in Germany 72 years ago.

MR. FREDERIC HOLLY REED, civil engineer and capitalist, who assisted in building the first experimental electric street railway in the United States and later installed trolley lines in various cities, died of heart disease at his home in New York City, December 9. He was born in Stamford, Conn., August 22, 1865.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

BRATTLEBORO, VT.—A new street-lighting system on Main and intersecting streets is contemplated.

MONTPELIER, VT.—C. H. Thompson, general manager of the Central Power Corporation of Vermont, has announced that his company has arranged for the purchase of 5,000,000 kilowatt-hours per annum from the Ontario Paper Company, Limited, to be used as a reserve power for the development of Montpelier and Barre. This power will be developed on the Green River and construction of the plant is expected to commence at once. The development is entirely for the purpose of bulk sale of electrical energy through the Central Power Corporation of Vermont as distributors, which has appeared before the Barre City Council asking for a franchise for a power line in that city.

BOSTON, MASS.—The Bay State Street Railway Company has been authorized to issue coupon notes to the amount of $2,500,000, the proceeds to be used for the purpose of reconstructing track and overhead equipment, and of replacing rolling stock and other items of railway property. The following power-plant equipment probably will be purchased: Two 2,500-kilowatt turbogenerators, one for the Lynn station and one for the Chelsea station; three 400-horsepower, two 150-horsepower and two 250-horsepower boilers for replacement.

PLYMOUTH, MASS.—The Plymouth Electric Light Company has petitioned the Massachusetts Gas & Light Commission for authority to issue $130,000 additional capital stock, making the total $400,000.

DEVON, CONN.—The United Electric Light & Water Company, of Waterbury, Conn., has announced that it has purchased a site in this city for the erection of a power plant estimated to cost $1,000,000.

COHOES, N. Y.—Development of the waterpower site at Cohoes Falls, involving extensive construction work, is indicated as the purpose of the Cohoes Light & Power Company, recently incorporated. The new company is capitalized at $5,000,000 and is authorized to supply electric light, heat and power for general purposes in Albany, Cohoes, Watervliet, Green Island, Colonie, Waterford, Clifton, Park and Halfmoon. The company's five directors are John J. Gallagher, Carl B. Rood and Louis B. Grant, of Brooklyn; Richard J. Barry, of Long Island City, and James A. Eyrne, of New York City.

QUEENS, N. Y.—The Queensboro Gas & Electric Company will erect a two-story brick power house on Clinton Street, Far Rockaway, to cost about $90,000.

NEW YORK, N. Y.—The Ward Baking Company is taking bids for the erection of a new powerhouse addition to its plant. C. B. Comstock, New York, is the architect.

BAYONNE, N. J.—Effective with the inauguration of a new street-lighting system on Broadway, from Andrew Street to Twenty-fourth Street, December 4, the Board of City Commissioners has approved the extension of the system in the district covered by Tenth to Eighteenth Streets. An extension to the system to the Canal bridge is also planned, to form a continuous white way along Broadway.

HIGHTSTOWN, N. J.—With the completion of a new 13,000-volt transmission line to Trenton, connecting with the power station of the Public Service Electric Company, the Electric Light & Power Company has inaugurated a local 24-hour electric service. Additional switchboard and transformer equipment will be installed immediately.

NEWARK, N. J.—The General Leather Company will build a one-story boiler-room addition to its plant on Frelinghuysen Avenue.

NEWTON, N. J.—The Town Committee is negotiating with the Newton Gas & Electric Company for an electric street-lighting system. Harvey Snook is Town Engineer.

HAZELTON, PA.—The Lehigh Coal & Navigation Company will electrify its Cranberry mines, to provide electric operation for all departments. While originally estimated to require four years for complete installation, it is planned to equip the plant and operate prior to this time.

JENKINTOWN, PA.—The Philadelphia & Suburban Gas & Electric Company has awarded a contract for the erection of a new two-story building, about 40 by 60 feet, for local service.

LEBANON, PA.—The Edison Electric Illuminating Company has entered into an agreement with the Blue Mountain Electric Company to furnish electrical energy for a period of 15 years. The Edison company will extend its 13,00-volt transmission line about two and one-half miles east of Myerstown to make connection with the present Blue Mountain system. The Blue Mountain company will abandon its present hydroelectric plant near Rehrersburg. The company is planning for the construction of a new high-tension line from Myerstown to Mount Aetna, connecting the terminus of the Reading Transit Company, of which it is a subsidiary, at Womelsdorf with the lines of the Lebanon division.

PHILADELPHIA, PA.—The Philadelphia Electric Company has purchased several tracts of land in Bartram Avenue near Seventy-fifth Street and Eighty-eighth Street to be used as sites for power stations, in connection with the extension of its service in Chester and other points.

POTTSTOWN, PA.—In connection with other improvements, the Nagle Steel Company is installing a new electric generating plant for shop operation.

SCRANTON, PA.—The Keystone Utilities Company is arranging to take over and operate the following electric properties in York County: Hanover Light, Heat & Power Company, Gettysburg Electric Company and the Hanover & McSherrytown Street Railway Company.

SOUTH BETHLEHEM, PA.—The Bethlehem Steel Company will make the following additions at its steel works, Sparrows Point, Md.: New gas-driven electric generator house, 120 by 600 feet; new gas-engine blowing plant, 102 by 376 feet; and an extension to the present gas-engine blowing house, 102 by 176 feet. Contract for erection has been awarded to Irwin & Leighton, Philadelphia. The estimated cost is $900,000.

FRANKLIN, VA.—Bonds in the sum of $40,000 have been issued, part of the proceeds to be used for improvements to the local electric-lighting system.

RICHMOND, VA.—The Virginia Railway & Power Company will extend its transmission lines to the American Locomotive Works, where energy will be furnished for motor operation.

BLUEFIELD, W. VA.—The Appalachian Power Company is making a number of improvements in its transmission and distributing systems, including a connection with the generating and transmission system of the Norfolk & Western Railway.

CLARKSBURG, W. VA.—The Monongahela Valley Traction Company has entered into an agreement with the Clarksburg Light & Heat Company by which a large transformer station will be erected here to enable the companies to exchange power in case of emergencies.

HARTLAND, W. VA.—The Hartland Power Company has been incorporated with a capital of $700,000 to build and operate an electric light and power plant here. The incorporators are John B. Hart, Osman E. Swartz, E. B. Templeman, R. O. Fallon and W. G. Stathers, all of New York City.

MARTINSBURG, W. VA.—The Potomac Light & Power Company will have plans prepared for improvement and reconstruction of dams Nos. 4 and 5 on the Potomac River.

MADISON, N. C.—A franchise will be granted for the installation of an electric-lighting plant here.

CHARLESTON, S. C.—The City Council is considering the purchase of the holdings of the Charleston Light & Water Company for a consideration of $1,360,000.

STUART, FLA.—The Southern Utilities Company of Jacksonville, has been granted a franchise to install and operate an electric-lighting plant here.

NORTH CENTRAL STATES.

BELLAIRE, O.—The City Council is considering plans to establish an electric-lighting plant at the waterworks station.

BOWLING GREEN, O.—The Ohio Northern Public Service Company has been incorporated with a capital of $1,000 by Martin J. Insull and others.

CANTON, O.—The Canton Electric Company will construct a garage, with repair shop and storehouse, at its plant, to cost about $30,000. Lighting and repair equipment will be installed.

COLUMBUS, O.—The Ohio State University's budget for 1917 includes an appropriation for a new power plant.

COLUMBUS, O.—The Ohio State Telephone Company has secured permission from the Public Utilities Commission to issue $2,600,342 additional preferred stock. The sum of $1,109,837 is to be used in extensions and additions. The company plans to spend $350,000 for improvements in Columbus.

COLUMBUS, O.—Orders have been placed for new equipment for the Marion and Stratford power plants and the Prospect substation of the Columbus, Delaware & Marion Railway Company by Eli M. West, receiver for the company. The improvements will cost about $30,000.

LIMA, O.—The local Y. M. C. A. has plans and specifications for a new building and will submit bids to the building committee, including separate bids on the electrical work involved.

LORAIN, O.—The Citizens' Gas & Electric Company, of this city, has asked the Ohio Public Utilities Commission for permission to sell its propertes to the Lorain County Electric Company for $250,000.

MASSILLON, O.—The City Engineer will advertise for bids on the new street-lighting system which has been approved for the use of the city, at the estimated cost for maintenance of $25,000 a year. The Massillon Electric & Gas Company submitted this estimate.

TOLEDO, O.—The Bell Telephone Company will make improvements and extensions amounting to $300,000 in Toledo. The removal of telephone poles and the installation of underground systems on many streets will be included in the work.

BROWNSTOWN, IND.—The Jackson County Transmission Company has been incorporated with a capital of $15,000 by E. F. Reason, W. Jessup and F. G. White to furnish electric service in this vicinity.

SOUTH BEND, IND.—Plans are being made for the installation of 214 five-lamp ornamental standards here, construction to be done by the Indiana-Michigan Electric Company.

DIXON, ILL.—The Illinois Northern Utilities Company has announced that it will build a large central power plant here with sufficient capacity to operate all of the company's properties in Northern Illinois. The plant will cost about $300,000 and have a capacity of 5,000 horsepower. Some of the equipment has been ordered.

FOUNTAIN, MICH.—The City Council is planning ways and means to secure an electric-lighting system.

WHITEHALL, MICH.—The Frugale Power Company, which operates hydroelectric plants at Montague and Ferry, is seeking a franchise to furnish electric service here.

AMHERST, WIS.—The Amherst Electric Company is seeking a franchise to furnish

electric service to the village of Amherst Junction and will erect a three-mile transmission line if it is secured.

KNAPP, WIS.—Plans are beng made here for the establishment of an electric-lighting plant. L. Teegarden is interested in the project.

PORTAGE, WIS.—Engineer T. C. Rutz, of the construction department of Woodmansee & Davidson, consulting engineers, of Chicago, Ill., has opened offices in this city through which all the construction work for the Wisconsin Power, Light & Heat Company, including the erection of a new auxiliary power plant here and construction work on 107 miles of new transmission lines to Portage, will be done. The new plant here will be connected with 11 cities and villages in the immediate vicinity.

WHITEWATER, WIS.—The Council is considering the installation of an ornamental lighting system in the business district.

MINNEAPOLIS, MINN.—It has been announced that the Minneapolis General Electric Company will erect a $500,000 building at Chestnut Avenue and Sixteenth Street. It will be 200 by 375 feet and will contain a substation, storage space and repair shops. W. T. Walker is superintendent of construction for the company.

ST. CLOUD, MINN.—Petitions asking for the installation of arc lamps in Ninth Avenue South and in Cooper Avenue have been granted by the City Commission.

TOWER, MINN.—The City Council is planning to install a 125-horsepower engine in the municipal electric-lighting plant.

NEW HAMPTON, IOWA.—Improvements will be made to the municipal electric-lighting plant, including the installation of additional generating equipment.

HIGBEE, MO.—The local electric-lighting plant has been sold to the Moberly Light & Power Company, which will furnish 24-hour service from its plant in Moberly.

McHENRY, MO.—Bonds for the erection of an electric-lighting plant have been approved by voters here.

MULLINVILLE, KANS.—A bond issue of $15,000 has been authorized to pay for the construction of a local distribution system and transmission line.

CORTLAND, NEB.—The Council has appointed a committee to secure estimates on the cost of the installation of a municipal electric-lighting plant.

OAK, NEB.—The Meyer Hydro-Electric Company contemplates a number of extensions to its transmission system.

WAKEFIELD, NEB.—The holdings of the Wakefield Electric Light Company have been sold to S. B. Knudson of Hartington. It is understood that the local plant will be one of a number in this section to be operated from the central source of power.

DELL RAPIDS, S. D.—The city is contemplating the installation of a power plant and street-lighting system to cost about $40,000. G. O. Lund, Electrical Development Company, Omaha, Neb., has prepared plans.

PHILIP, S. D.—The Philip Light & Power Company has been incorporated by O. K. Whitney and others to furnish electric light and power. The capitalization is $10,000.

CALVIN, N. D.—The installation of an electric-lighting system in Calvin, to cost about $3,500, is under consideration.

DRISCOLL, N. D.—The Driscoll Telephone Company, capitalized at $10,000, plans the construction of 75 miles of line.

SOUTH CENTRAL STATES.

CAMPBELLSVILLE, KY.—G. W. Herses, of Louisville, and Charles Walls, of Lebonan, Ky., have purchased the local plant of the Campbellsville Public Utilities Company and have assumed control. They propose to install a 100-horsepower and a 25-horsepower engine.

MT. STERLING, KY.—The City Council has renewed a contract with the Kentucky Utilities Company to run for a period of three months from February 1. It provides that the local lighting plant is to be kept in condition for instant operation in case of failure of the large plant at Lexington. At the same time the city has contracted for replacement of the arc lamps with new incandescent lamps.

WINCHESTER, KY.—The city is having plans prepared for a 2,000-horsepower hydroelectric plant at Lock 10 on the Kentucky River, to furnish power for the operation of municipal plants. Edgar B. Kay, 305 Colonial Building, Winchester, is the engineer.

DUMAS, ARK.—The Board of Improvements has sold a bond issue of $15,000, the proceeds to be used for the erection of an electric-lighting plant. A large part of the machinery has been purchased.

HUNTINGTON, ARK.—A quarter of a million dollar electric light and power plant is to be erected at Huntington in the event that a utilities corporation of which Albert Emanual, of Dayton, O., is president, closes options it has obtained on the Coal & Gas Belt Electric Company, of Huntington; the Greenwood Light & Power Company, of Greenwood, and the Light & Power Company, of Booneville, and other companies. Raymond F. Rice, Lawrence, Kans., is counsel for the Emanual corporation.

ARDMORE, OKLA.—An electric line probably will be constructed from this city to the new oil field at Fox, Okla. The Ardmore Railway Company is behind the project. The company ultimately plans to develop water power on the Washita River.

MANGUM, OKLA.—This city has been involved in litigation over the issuance of $100,000 in bonds voted for erection of a municipal light plant. A temporary injunction has been dissolved against the sale of the bonds by City Commissioners and work on the plant is expected to begin soon. A pumping plant is planned in connection with a hydroelectric plant.

MIAMI, OKLA.—Bonds in the sum of $25,000 have been voted for improvements to the municipal electric-lighting and waterworks plants.

DENISON, TEX.—The Texas Power & Light Company, of Dallas, which some time ago entered into a contract with the city involving the construction of a new electric power station to be situated on the Red River near here, announces that it will apply for a three-year extension of the contract. The proposed plant is to cost approximately $600,000.

GALVESTON, TEX.—The Galveston Electric Company is installing a motor-generator set at its plant at Twenty-first Street and Avenue I, at a cost of $10,000.

GREENVILLE, TEX.—The proposition of selling the municipal electric light and power plant to the Texas Power & Light Company will be submitted to vote.

HIGGINS, TEX.—A municipal electric-lighting and waterworks plant will be built here. Bonds have been issued for the purpose.

SHINER, TEX.—The City Council will install a crude-oil engine, dynamo and other equipment in the municipal electric-lighting plant.

WELLINGTON, TEX.—B. F. Godwin has purchased the local electric light and power plant from the Wellington Light & Power Company. Improvements will be made.

WESTERN STATES.

TERRY, MONT.—The Terry Development Company, recently organized to engage in the electric light and power business, has purchased the holdings of the Terry Light & Power Company. The new concern will install additional generating equipment.

LIBBY, MONT.—An auxiliary power plant operated by a 125-horsepower crude-oil engine costing about $10,000 and entirely separate from the present hydroelectric plant will be installed by the Libby Water Works Electric Light & Power Company.

LIBBY, MONT.—The International Power & Construction Company has filed a condemnation suit against the Great Northern Railway Company and David R. McGinnis to make it possible to erect a dam to harness the Kootenai River at Kootenai Falls for electricity. The company was recently organized by Leo H. Faust and C. E. Lukens, and capitalized at $250,000.

PUEBLO, COLO.—The Arkansas Valley Railway, Light & Power Company is contemplating a number of extensions to its high-tension transmission lines to furnish power for several irrigation projects in the Arkansas Valley.

TULAROSA, N. M.—Plans are being made here for the installation of an electric-lighting system.

BISBEE, ARIZ.—Extension to the local electric-lighting system are planned.

NORTH YAKIMA, WASH.—The Tieton Water Users' Association, through its president, H. M. Gilbert, will look into the possibilities of a hydroelectric plant on the present Tieton canal and at the McAllister Meadows. A plant with a capacity of 100,000 horsepower may be installed.

RITZVILLE, WASH.—Bids have been asked for by the City Council for the rewiring of the light and power circuits at pumping station No. 1 and the installation of a switchboard and auxiliary apparatus.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, has been requested to furnish an estimate of the cost of constructing a transmission line between this place and the Tacoma municipal plant, in order to take advantage of the rate the latter city is making for energy.

SPOKANE, WASH.—The Spokane Heat, Light & Power Company will open new salesrooms and offices about the first of the year in its building on South Post Street. The building housing the new 10,000-horsepower electric and steam plant is also approaching completion. The present plant is but the first section of what will be one of the largest in the West. It is planned to eventually develop 30,000 horsepower. Over $1,700,000 has been spent for construction during the past year.

TACOMA, WASH.—Llewellyn Evans, superintendent of the local municipal lighting plant, is making an investigation of sites for a new hydroelectric power plant, as the maximum of the present plant will be reached by 1921. It would require three years to complete the plant and the City Council favors immediate development.

PORTLAND, ORE.—The City Auditor has called for bids for lighting the streets and municipal buildings of this city.

COLTON, CAL.—The City Trustees have deferred action on the bids for supplying the city with copper wire.

ESCONDIDO, CAL.—Negotiations are pending for the purchase of the local electric and gas plants by the San Diego Consolidated Gas & Electric Company. If the deal is made, the company will connect the local system with its own power plant, and purchase some energy from the Escondido Mutual Water Company, which has a hydroelectric plant in connection with its irrigation system. The two plants may be connected by the installation of a transmission line by way of Vista, either from the power line at South Oceanside or at Bonsall. In either event light and power will be furnished to the communities en route.

FULLERTON, CAL.—The Pacific Electric Company will begin work soon on an extension of its line into this city.

HALF MOON BAY, CAL.—The property and business of the Half Moon Bay Light & Power Company have been sold to the Great Western Power Company, of San Francisco.

LONG BEACH, CAL.—The work of reconstructing the city electric fire-alarm system has been commenced.

LOS ANGELES, CAL.—Through the efforts of the Athens Improvement Association that section of Los Angeles will soon have a new lighting system.

LOS ANGELES, CAL.—The Southern California Edison Company and the Pacific Light & Power Corporation have filed application with the State Railroad Commission for the merger of the two companies.

LOS ANGELES, CAL.—The Board of Public Works has asked for bids for installing and maintaining electric service for one year on Beacon Street between Fourth and Sixth Streets, and on Sixth Street between Palos Verdes and Pacific Streets.

DATES AHEAD.

American Association for the Advancement of Science. Annual meeting, New York City, December 26-30. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

American Institute of Chemical Engineers. Annual convention, New York City, January 10-13, 1917. Secretary, J. C. Olson, Cooper Union, New York, N. Y.

Electrical Contractors' Association of Wisconsin. Annual meeting, Hotel Wisconsin, Milwaukee, Wis., January 15-17. Secretary, Albert Peterman, 626 Lloyd Street, Milwaukee.

Western Association of Electrical Inspectors. Annual meeting, Hotel Secor, Toledo, O., January 23-25. Secretary, W. S. Boyd, 175 West Jackson Boulevard, Chicago, Ill.

New Mexico Electrical Association. Annual convention, Albuquerque, N. M., February 12-14. Secretary pro tem., E. A. Thiele, Roswell, N. M.

ORANGE, Cal.—The Board of Supervisors has advertised for sale the electric-lighting franchise applied for by the San Diego Consolidated Gas & Electric Company.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company will install a transmission line from Cardiff to the Encinitas Copper Company's mine.

SAN FRANCISCO, CAL.—The Mission Promotion Association is considering plans for a new lighting system on Sixteenth Street between Howard and Dolores.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company has applied to the State Railroad Commission for permission to furnish electric service in San Benito County.

SAN FRANCISCO, CAL.—The California State Railroad Commission has issued an order authorizing the Northern California Power Company to extend its lines from College City, Cal., to Dunnigan, Cal., and to furnish electricity to all of Yolo County, Cal., not now served by the Pacific Gas & Electric Company.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has announced the completion of the Halsey hydroelectric station at the Lake Spaulding development, one of the chain of power plants which will secure their water from the Lake Spaulding reservoir. This new plant, with the Wise plant now almost ready for operation, will add 33,000 horsepower to the generating capacity of Pacific Gas & Electric. With the Drum plant, the first of the Lake Spaulding stations to be completed, the company will have 66,000 horsepower at this development, giving a total of 265,250 horsepower generating capacity at all plants. While the operation of the two new plants will not require any additional supply of water, as they will use the water which has already passed through the turbines at the Drum plant, the company, in anticipation of the construction of additional power stations at Lake Spaulding, has added 35 feet to the dam, making it 260 feet high and increasing by 50 per cent the water storage capacity of Lake Spaulding. With the coming spring construction of a fourth hydroelectric development of 33,000 horsepower will be started at Lake Spaulding. All the generating capacity of the new power stations will be taken at once either by new business or by the substitution of hydroelectric energy for that generated in the steam power plants of the company.

SAN LEANDRO, CAL.—Electroliers will be installed in connection with the new lighting system.

VALDEZ, ALASKA.—The Prince William Sound Water, Light, Power & Telephone Company, with offices in Seattle, has purchased the Illes Hydro-Electric Company, of this place, for about $100,000. The former company furnishes light, power and heat to Valdez, Liscom and other portions of the district. It will operate both plants until extensions are made which will consolidate them at this point.

CANADA.

PORT ARTHUR, ONT.—The City Council has decided to submit a by-law at the January elections to find if the electors want the Hydro-Electric Commission to develop, construct and acquire some 30,000 horsepower for the city, probably at Dog Lake. The city at present consumes about 30,000 horsepower, which is secured from Current River, and about 2,300 horsepower which is secured through the Hydro-Electric Commission from the Kaministiquia Power Company of Fort William. The influx of new industries and elevators into the city will increase the consumption in this city by several thousand horsepower in the immediate future, and in the event of the Kaministiquia Power Company not being able to supply this from its present plant another source of power is necessary. The proposed plant is estimated to cost several millions of dollars.

TORONTO, ONT.—The Ontario Hydro-Electric Commission has decided to undertake at once the construction of the projected canal between Chippewa Creek and Queenston for the supply of 200,000 horsepower of electrical energy for the hydro-electric system. The work will be carried on under the direct control of the commission, which proposes to procure electrically driven excavating machinery to avoid the element of fuel cost and save labor. The electrical equipment will call for general excavation machinery of the heaviest type and its cost is estimated at between $800,000 and $900,000. The cost of the entire canal, which will be about 12 miles in length, is estimated at $9,000,000.

New Incorporations

HILLSBORO, ILL.—Saline Electric Company has increased its capital stock from $250,000 to $1,100,000.

MILWAUKEE, WIS.—Crown Gas & Electric Fixture Company. Capital, $20,000. Incorporators: Emil Dietz, J. J. Arnheim and F. A. Lofty.

SALT LAKE CITY, UTAH.—The Power Electric & Hardware Company. Capital $25,000. Incoporators: Roy Boren, J. W. Lierly and others.

ORANGE, N. J.—Orange Electric Garage Company. Capital $50,000. Incorporators W. Carver, East Orange; J. A. Savage and A. E. McGeehan, Newark, N. J.

ST. LOUIS, MO.—Magnet Manufacturing Company. Capital $10,000. Do a general electrical appliance business. Incorporators: I. Korach, L. F. Korach and M. D. Frumberg.

SALT LAKE CITY, UTAH.—Salt Lake Electric Talking Sign Company. Capital, $100,000. General advertising. Incorporators: R. L. Turner, J. W. Webb and others.

KANSAS CITY, MO.—Kansas City Chandelier Company. Capital, $12,000. Manufacture fixtures. Incorporators: Albert Jacobson, Jacob Lebrecht and Irwin Jacobson.

JOPLIN, MO.—The Joplin Electrieal Supply Company. Capital $10,000. Deal in electrical supplies and equipment. Incorporators: C. H. Belden, E. M. Confer and Rex Chamblin.

ST. LOUIS, MO.—Electric Material Company. Capital, $5,000. Do a general electrical machinery and appliance business. Incorporators: C. R. Baldwin, C. J. Cummiskey and W. L. Cummiskey.

DOVER, DEL.—Commonwealth Electric Washer Company of Chicago. Capital, $250,000. Manufacture electric washing machines. Incorporators: George A. Evans, L. L. Cowan and R. Montgomery, Chicago.

DOVER, DEL.—Efficiency Turbine Company of New York. Capital, $300,000. Manufacture engines, dynamos, motors, etc. Incorporators: G. Carl Schick and Frederick Caner, New York City, and Kellogg Sherwood, Brooklyn, N. Y.

NEW YORK, N. Y.—Hawkins-Ives Corporation. Capital, $10,000. Manufacture electrical appliances, etc. Incorporators: William W. Hawkins, 231 Hancock Street, Brooklyn, N. Y.; Alfred E. Ives, Jr., 80 Maple Avenue, Rockville Centre, N. Y., and Robert C. Ream, 929 Park Avenue, New York City.

Foreign Trade Opportunities

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D.C., or its offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 23,188. ELECTRIC BULBS.—A firm in Gibraltar is in the market for electric bulbs for 16, 25, and 50-candlepower lamps, fitted with standard Edison screw caps of 114 volts. It is also in the market for all kinds of electric appliances.

NO. 23,196. ELECTRICAL APPLIANCES.—A wholesale merchant in Spain desires to represent American manufacturers and explorters of tools, electric curling irons, electric cloth cutters, etc. Quotations should be made c. i. f. destination. Correspondence in Spanish. References.

NO. 23,213. ELECTRIC LIGHTING FIXTURES.—A firm in Portugal desires to represent American manufacturers and exporters of electric-lighting fixtures. Correspondence in English. Reference.

NO. 23,229. ELECTRICAL APPARATUS.—A man in Spain would like to be placed in communication with American manufacturers and exporters of dynamos, electric motors, electric lamps, electric wires, and all kinds of electrical materials. Quotations should be made c. i. f. destination. Payment will be made against shipping documents. Correspondence in Spanish. Reference.

Financial Notes

Ohio State Telephone Company will offer the $2,000,000 additional seven-per-cent preferred stock, just approved for issue by the Ohio Public Utilities Commission, to its stockholders at par on the basis of one share of the new stock for each five shares of common or preferred stock now held.

The North American Light & Power Company at a special meeting of its stockholders at Portland, Me., voted to increase its capital stock from $6,000,000, consisting of 60,000 shares at $1,100 each, 10,000 being common and 50,000 being preferred, to $11,000,000, consisting of 110,000 shares at $100 each, 10,000 being common and 100,000 being preferred.

Recent advances in Montana Power shares are accompanied by various reports regarding the future developments in this company, but the one which obtained greatest credence is that Montana Power will be the source from which Great Northern will secure the energy for its electrification. Officials of the railroad and of Montana Power are making inspection of the 440 miles of electrified line of the Chicago, Milwaukee & St. Paul railroad.

The Northern Ohio Traction & Light Company, the operating subsidiary of the Northern Ohio Electric Corporation, has applied to the Ohio Public Utility Commission for authority to issue $1,000,000 common stock at par, the proceeds to be used for construction work and extension. Northern Ohio Electric Corporation owns over 95 per cent of the present outstanding common stock of Northern Ohio Traction & Light and the new stock will be taken by the holding company.

According to the statement of the United Light & Railways Company for the 12 months ending October 31, the total gross earnings amounted to $1,860,816.79, an increase of $316,203.87, or 20.5 per cent. The net earnings were $1,146,747.04, an increase of $233,485.21, or 25.6 per cent. Surplus earnings, $552,724.04, a gain of $186,403, or 50.9 per cent. The total gross earnings of the subsidiary companies reached $6,793,885.96, a gain of $598,072.98, or 9.6 per cent. The net profit was $1,274,742.02, an increase of $233,137.70, or 23.1 per cent.

J. P. Morgan & Company, syndicate managers for the American Telephone & Telegraph Company $80,000,000 collateral five-per-cent bonds, announce that allotments have been made on the basis of awarding in full separate applications of $1,000 bonds and less; 30 per cent on individual subscriptions between $1,000 and $10,000 with a minimum of $1,000; and 20 per cent on individual subscriptions above $10,000 with a minimum of $3,000 bonds. Where the total allotment of $10,000 bonds or more to an individual subscriber contains a fraction of part of $1,000, the fraction is eliminated.

The American Railways Company has sold to Newberger, Henderson & Loeb and Bioren & Company, of Philadelphia, and Scott & Company, of Wilmington, Del., $2,475,000 of its five-per-cent 30-year bonds secured by the deposit as collateral of

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Dec. 11	Dec. 4
American Telephone & Telegraph (New York)	128	127½
Commonwealth Edison (Chicago)	143	141
Edison Electric Illuminating (Boston)	227	228
Electric Storage Battery common (Philadelphia)	70	72
Electric Storage Battery preferred (Philadelphia)	70	72
General Electric (New York)	179	179
Kings County Electric (New York)	125	124
Massachusetts Electric common (Boston)	4½	4¾
Massachusetts Electric preferred (Boston)	28	28½
National Carbon common (Chicago)	....	290
National Carbon preferred (Chicago)	....	133
New England Telephone (Boston)	125	124½
Philadelphia Electric (Philadelphia)	29⅝	29⅝
Postal Telegraph-Cables common (New York)	84	84¾
Postal Telegraph-Cables preferred (New York)	65	65½
Western Union (New York)	102	101
Westinghouse common (New York)	61	63¾
Westinghouse preferred (New York)	72	72

$1,675,000 first-mortgage five-per-cent bonds of the Ohio Valley Electric Company and $800,000 five-per-cent bonds of the Consolidated Light & Power Company. These bonds of the controlled companies are guaranteed, principal and interest, by the American Railways Company. The American Railways Company has called for payment February 1, at 100.5 and interest, $628,000 of the $2,300,000 three-year five-per-cent notes issued February 1, 1916.

Under the Voorhees tax act, covering a levy of five per cent on the taxable gross receipts of street railways and two per cent on other utilities, a total of $1,535,554 will be paid to the various counties in New Jersey for the year 1916. The assessments for the entire state are: Thirty-one street railways, $797,088.71; 115 electric light and gas companies, $490,127.18; 114 water companies, $80,846.66; 41 telephone and telegraph companies, $159,795.58; three district telegraph messenger companies, $1,561.49; 17 sewer and pipe-line companies, $6,134.40. The increase in the corresponding tax assessment of 1915 is $29,777.06. At the forthcoming session of the state legislature a bill is to be introduced increasing the tax on all utilities to be equal to that now paid by street railways, five per cent. It is estimated that such a law will increase the revenue from this source by $1,000,000.

The New York Public Service Commission has issued an order granting the application of Kings County Electric & Power Company to issue $2,500,000 debenture six-per-cent bonds bearing date of March 1, 1913, convertible after three years into stock of the company and payable in 12 years. The proceeds are to be used in reimbursing the treasury for $600,000 expended for improvements between September 30, 1913, and September 30, 1914, and to take up $1,900,000 demand notes of the Edison Electric Illuminating Company of Brooklyn, the operating company. These demand notes are also formally approved. The debentures are to be issued subject to the company's securing an authorization for a corresponding increase in its capital stock and are to be sold at not less than par plus accrued interest. They are to be offered for subscription first to the stockholders of the Kings County Company, then to the Brooklyn Edison Investment fund which has been created under a profit-sharing and pension plan, and if there is still a remainder, to the general public.

The Canton Electric Company, the parent company in the consolidation of a score of smaller electric light and power companies in Ohio, hereafter will be known as the Central Power Company. R. E. Breed of New York, president of the American Gas & Electric Company, will be president of the Central Power Company, which includes power plants at Logan, Shawnee, Mt. Vernon, Newark, Lancaster, Crooksville, Fremont, Tiffin, Fostoria, Shadyside, Neffs, Glencoe, Bethesda, Barnesville, St. Clairsville, Dillonvale, New Yorkville and Wardrow. The various companies, including the Canton Electric Company, represent property said to be worth $10,000,000. The companies will be supplied with energy from one of the largest power plants in the country which has been completed just across the Ohio River in West Virginia, near Wheeling. Other companies are expected to be taken into the consolidation later. It is planned to incorporate the consolidated companies at $50,000,000.

Dividends.

	Term	Rate	Payable
Am. Pub. Util., pf.	Q	1.5 %	Jan. 1
Baltimore Electric	—	$1.25	Jan. 2
Buffalo Gen. Elec.	Q	1.5 %	Dec. 30
Cent. Sts. Elec. Corp., pf.	Q	1.75%	Dec. 30
Cleveland St. Ry.	Q	1.5 %	Jan. 1
Dayton Pw. & Lt., pf.	Q	1.5 %	Jan. 1
Duluth-Superior Trac., pf.	Q	1 %	Jan. 2
El Paso Elec., pf.	Q	$3.00	Jan. 8
Elec. Stor. Batt., com.	Q	1 %	Jan. 2
Elec. Stor. Batt., pf.	Q	1 %	Jan. 2
Interborough Rap. Tran.	Q	5 %	Jan. 2
Manila Elec. R. R. & Ltg. Corp.	Q	1.5 %	Dec. 30
National Gas, Elec. Lt. & Pw., com.	Q	1 %	Jan. 1
National Gas, Elec. Lt, & Pw., pf.	Q	1.5 %	Jan. 1
New Orleans Ry. & Lt., pf.	Q	1.25%	Dec. 30
New Orleans Ry. & Lt., com.	Q	0.25%	Dec. 30
So. Utilities, pf.	Q	1.75%	Dec. 30
Spgfld. (Mo.) Ry. & Lt., pf.	Q	1.75%	Jan. 2
Toronto Ry.	Q	2 %	Jan. 2
Tri-City Ry. & Lt.	Q	1 %	Jan. 1
Tri-City Ry. & Lt., pf.	Q	1.5 %	Jan. 1
Twin City Rap. Trans., pf.	Q	1.75%	Jan. 2
Twin City Rap. Trans., com.	Q	1.5 %	Jan. 2
Union Trac. (Phila.)	—	$1.50	Jan. 1
Un. Trac. & Elec. (Prov.)	Q	1.25%	Jan. 2
Un. Trac. & Elec. of N. J.	Q	1.25%	Jan. 2
United Lt. & Rys., pf.	Q	1.5 %	Jan. 2
United Lt. & Rys., com.	Q	1 %	Jan. 2
West End St. Ry. (Boston), pf.	—	$2.00	Jan. 2
Western Elec.	Q	$2.00	Dec. 30
Western Elec., pf.	Q	1.5 %	Dec. 30

Proposals

ELEVATORS.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until December 18, for two electric freight elevators, one each for the new structural shops at the navy yards, Norfolk, Va., and Philadelphia, Pa. Plans and specifications may be had on application to the Bureau of Yards and Docks, or to the commandants of the navy yards named.

ELECTRIC LIGHTING PLANT.—Sealed tenders will be received until December 18 by C. J. O'Keefe, City Clerk, Spencer, Iowa, for the labor and material required for installation of electric light and power plant of a capacity of approximately 375 kilovolt-amperes. Specifications and tender forms may be obtained from W. E. Skinner, consulting engineer, 415 Plymouth Building, Minneapolis, Minn.

SWITCHBOARD PANELS.—Sealed bids will be received until December 18 by the City of Chicago, Ill., at Room 2001, City Hall Square Building, for fabricating, delivering and erecting two switchboard panels and accessories in the power house at the municipal reduction plant, Thirty-ninth and Iron Streets, according to plans and specifications on file in the office of the Bureau of Waste Disposal, 2001 City Hall Square Building.

ELEVATORS.—Sealed proposals will be opened in the Supervising Architect's office, Treasury Department, Washington, D. C., December 27, for the installation complete of two new electric passenger elevators, etc., in the United States appraisers' warehouse, New York, N. Y., in accordance with the specification, copies of which may be had at that office or at the office of the Supervising Chief Engineer, in the discretion of the Supervising Architect. James A. Wetmore, Acting Supervising Architect, Washington.

CRANES.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until December 18, for furnishing and installing one 80-ton bridge crane, three 15-ton bridge cranes, 12 five-ton wall cranes, and eight three-ton wall cranes, more or less, in each of the new structural shops at the navy yards, Norfolk, Va., and Philadelphia, Pa. Plans and specifications may be obtained on application to the Bureau of Yards and Docks or to the commandants of the navy yards named.

Electrical Patents Issued December 5, 1916

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,206,794. **Spark-Plug.** J. W. Baird, Chicago, Ill. Comprises a fan wheel for circulating gases.

1,206,812. **Wire-Holding Clip.** W. Callaway, Wichita, Kans. For supporting a strand of wire; formed from sheet-metal blank.

1,206,815. **Illuminated Oil-Gauge.** M. L. Cranmer, Chicago, Ill. Arrangement of lamp housing.

1,206,826. **Lamp Bracket.** C. Englert, Rochester, N. Y. Adjustable lamp cord support for attachment to ceiling.

1,206,844. **Electric Headlight.** H. J. Hoag, Cloversville, N. Y. Arrangement of reflectors.

1,206,845. **Fire-Alarm System.** G. W. Hochsprung, assignor to J. Kothe, Jersey City, N. J. Single main circuit with automatic make-and-break box.

1,206,846. **Insulator.** R. S. Hopkins, Fairmont, W. Va. Pin type; adapted to secure and connect ends of live wires.

1,206,850. **Ventilation System for Storage-Battery Cells.** A. S. Hubbard, assignor to Gould Storage Battery Co., New York, N. Y. Arrangement of pumping system

1,206,855. **Trolley-Supporting Mechanism.** C. Kasper, Chicago, Ill. Pantograph arrangement.

1,206,874. **Utilization of Aluminum Chlorid Residues.** A. McAffee, assignor to Gulf Refining Co., Pittsburgh, Pa. Aluminum is obtained by electrolysis.

1,206,881. **Method of Making Diaphrams.** H. C. Miller, Waterford, N. Y. Copper is electrodeposited and nickel then electrodeposited thereon to impart desired qualities of resiliency, etc.

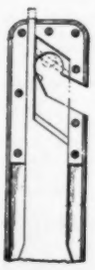
1,206,882. **Insulating Tube.** C. T. Morene, Nixon, Tex. For insulating wires through partitions, etc.

1,206,885. **Method of Electrical Edge-Welding.** T. E. Murray, New York, N. Y. For producing welded body of the desired dimensions.

1,206,890. **Method of Electric Spot-Welding.** T. E. Murray and L. H. Hoffer, New York, N. Y. For uniting two plates, one of which is thinner than the other.

1,206,907. **Carbon-Brush Holder.** J. B. Peters, assignor to Electric Auto-Lite Co., Toledo, O. For motors and dynamos.

1,206,911. **System of Radio Communication.** G. W. Pickard, assignor to Wireless Specialty Apparatus Co., Boston, Mass.



No. 1,206,985.—Safety Hot-Wire Cutter.

Arrangement of transmitter for electromagnetic waves.

1,206,955. **Railway Signalling.** H. A. Wallace, assignor to Union Switch & Signal Co., Swissvale, Pa. For turn-outs on single-track electric road.

1,206,963. **Electrolytic Apparatus.** R. L. Whitehead, assignor to American Smelting & Refining Co., Maurer, N. J. Structure of electrode facilitating electrical connection therewith.

1,206,964. **Casting Electrodes.** R. L. Whitehead, assignor to American Smelting & Refining Co. Mold and method for casting flat copper anode for electrolytic refining.

1,206,968. **Apparatus for Indicating Heat Ratios.** I. H. Wilsey, assignor of one-half to W. H. Green and one-half to F. A. Adkins, Chicago, Ill. Conductors spaced along furnace flue indicate heat differences through wheatstone bridge arrangement.

1,206,983. **Separator for Storage Batteries.** W. L. Bliss, assignor to U. S. Light & Heat Corp., Niagara Falls, N. Y. Finely divided, acid-resisting material is mixed with soluble material and bakelite as a binder, pressed into form and soluble material dissolved out to give porosity.

1,206,984. **Projecting Apparatus.** A. C. R. Bloom, Des Moines, Iowa. Light is extinguished synchronously with film movement.

1,206,985. **Safety Hot-Wire Cutter.** H. B. Bush, Redlands, Cal. For cutting live wire. (See cut.)

1,206,987. **Dictating Phonograph System.** H. P. Clausen, assignor to Western Electric Co., New York, N. Y. Transmitter connected by relay system with several recorders, another being automatically connected in when record of one is completed.

1,206,988. **Electrical Alarm.** J. G. Clemens, Buffalo, N. Y. Iron box has vibratory wall operated when alternating currents are applied to coil inside.

1,206,989. **Ruling Machine.** S. H. Cobb, Boston, Mass. Has a number of electrically controlled and actuated ruling devices.

1,207,016. **Circuit-Breaking Relay.** R. C. Fryer, Detroit, Mich. Structural details.

1,207,033. **Automobile Signal.** E. C. Hardwick, Galena, Kans. Unitary structure comprising visible and audible signals and motor for operating.

1,207,048. **Method of Electrolytically Recovering Metals.** W. A. Huseey, assignor

of one-half to J. H. Alling and one-half to F. M. Wright, San Francisco, Cal. For recovering metal from metalliferous pulp.

1,207,051. Telephone Repeater or Relay. A. H. Johnson, assignor of one-half to C. C. Houston, Lewisburg, Tenn. Special circuit arrangements for relaying signalling and talking currents.

1,207,084. Insulated Rail-Joint. E. F. Schermerhorn, assignor to Rail Joint Co., New York, N. Y. Manner of insulating splice bars from rails.

1,207,090. Means for Ventilating Telephone Booths. E. J. Stevenson, Boston, Mass. Fan motor is controlled by receiver hook.

1,207,097. Snap-Switch for Electric Uses. W. C. Tregoning, Cleveland, O. Pendent, push-button device.

1,207,099. Indicator, T. W. Varley, New York, N. Y. Device for imparting a continuous-direction, three-position movement to a signal arm.

1,207,126. Speed-Indicating Device for Motor Vehicles. A. A. Benson, assignor to Benson, Flick and Solberg, Seattle, Wash. Collision bar electrically controls speedometer lock to fix speed indication at time of collision.

1,207,127. Method of and Apparatus for Obtaining Zinc. E. S. Berglund, assignor to Trollhattans Electrothermiska Aktiebolag Trollhattan, Sweden. Carried out in electric furnace.

1,207,131. Insulated Rail-Joint. B. G. Braine, assignor to the Rail Joint Co., New York, N. Y. Manner of insulating joint bolts from splice bar.

1,207,150. Automatic-Telephone Switching System. A. H. Dyson, assignor to Western Electric Co. Operation of automatic switch and grouping of circuits.

1,207,155. Attachment for Electric Light Switches. M. C. Frank, Piedmont, Cal. Vacuum cup has luminous top.

1,207,156. Lamp-Socket Fixture. E. H. Freeman, Trenton, N. J. Manner of securing socket cap and cover to fixture.

1,207,157. Starting Device for Internal-Combustion Engines. E. Fuchs, assignor to L. Renault, Billancourt, France. Suspension of starting motor which is swung into and out of operative position.

1,207,168. Automatic Switch. A. W. Houchin, Greensboro, Md., assignor to Shockless Electric Manufacturing Co., of New Jersey. Switch in armature circuit is mounted on field of dynamo, biased to open and held closed by field flux.

1,207,169. Sparking Device for Hydrocarbon Engines. H. Hovgard, assignor to Star Instrument Co. Combined induction coil and spark plug.

1,207,170. Speed-Controlling Mechanism for Automobiles. M. J. Huggins, New York, N. Y. Speed-changing gears are electromagnetically controlled.

1,207,175. Light Fixture. J. T. Johnson, Atlanta, Ga. Shade holder.

1,207,193. Ignition System. C. T. Mason, assignor to Splitdorf Electrical Co., Newark, N. J. Circuits, switches, etc. for magneto having rotating field.

1,207,197. Armature Winding. T. M. Mueller, assignor to Maximum Electrical Co., Detroit, Mich. Structure of end connections.

1,207,221. Fraud-Preventive Device. O. Ruzsicska, assignor of one-sixth to H. Lieferant and one-sixth to S. Busch, Newark, N. J. Magnet controls obstruction to coin passage in coin-controlled machine.

1,207,260. Electrical Switch. H. A. Yearick, Sunbury, Pa. Details of lever-operated device.

1,207,261. Process of Recovering Gold. J. H. Alling, assignor of one-half to F. M. Wright, San Francisco, Cal. Electrolytic process of recovering from auriferous pulp.

1,207,287. Storage Battery, B. Ford, Philadelphia, Pa. Structure of container.

1,207,291. Signal. C. O. Harrington, assignor to Union Switch & Signal Co., Swissvale, Pa. Arrangement of reflector and lens in projector to throw separate beams.

1,207,293. Storage Battery. C. Hodge, Radnor, Pa. Process of fitting hard rubber jars to their boxes.

1,207,295. Means for Controlling Electrically Propelled Vehicles. O. Johnson, Chicago, Ill. Control of air brake, motor and track sander.

1,207,309. Apparatus for Purifying Water. H. Y. McIntyre, Milwaukee, Wis. Ozonating apparatus.

1,207,321. Insulator Support. C. L. Pierce, assignor of one-half to Hubbard & Co., Pittsburgh, Pa. Manner of securing insulator to pin.

1,207,325. Switch Lock. E. K. Post, Altoona, Pa. For railway track switch; is electrically controlled from a distance.

1,207,329. Controller Handle. S. Rousch, San Francisco, Cal. For railway-motor controllers.

1,207,347. Method of Obtaining Ultra-Violet Rays by Spark Discharge. J. Von Kowalski-Wierusz, Fribourg, Switzerland. Spark is damped, high-current amplitude is employed and the wave length of spark oscillations is less than 3,000 meters.

1,207,351. Electric Fuse. F. N. Wake, assignor to S. R. Prevost, J. M. Coote, E. F. Fisher and himself, trading under name of Electrical Safety Appliance Co., New York, N. Y. Refillable cartridge fuse.

1,207,359. Commutator. M. Auflero, Brooklyn, N. Y. Details of insulation and support of segments.

1,207,382. Primary Battery. T. A. Edison, assignor to New Jersey Patent Co., West Orange, N. J. Structure of negative electrode, cover, connections, etc.

1,207,384. Electric Amplifier. H. C. Egerton, assignor to Western Electric Co. Electromagnetic device for telephone circuits.

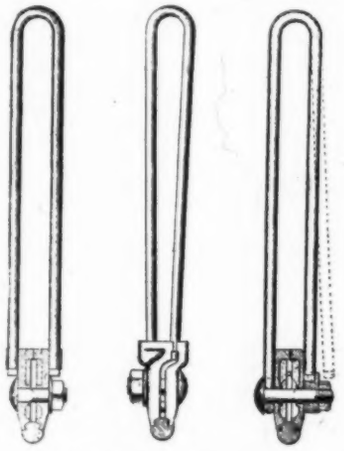
1,207,388. Method and Apparatus for Submarine Signaling. R. A. Fessenden, assignor to Submarine Signal Co. Method of selecting and utilizing periodic impulses.

1,207,395. Brake Lock for Automobiles. L. Goldmerstein, New York, N. Y. Details of electromagnetically controlled bolt.

1,207,419. Receiver. O. M. Leich and A. C. Ried, Genoa, Ill. Structure of head telephone receiver.

1,207,459. Catenary Hanger. H. R. Wolfe, assignor to Ohio Brass Co., Mansfield, O. For trolley wire. (See cut.)

1,207,463. Disconnecting Device for Telephones. C. H. Alger, Manchester, Okla.



Nos. 1,207,459, 1,207,483 and 1,207,484.—Catenary Hangers.

Switching device adapted to connect telephone line with ground when moved to disconnect instrument.

1,207,477. Label-Cutting Machine. J. R. Bignell, assignor to Fabric Patch Co., Grand Rapids, Mich. Label strip feeding jaws are automatically electromagnetically controlled.

1,207,483, and 1,207,484. Catenary Hanger. G. H. Bolus, assignor to Ohio Brass Co., Mansfield, O. For trolley wires. (See cuts.)

1,207,487. Insulated Rail-Joint. L. F. Braine, assignor to Rail Joint Co., New York, N. Y. Details of special structure.

1,207,503. Method of Recovering Clay and Slag from Used Retorts. C. C. Conover and A. N. Detweiler, Springfield, Ill. Retort and slag are crushed and the slag magnetically separated.

1,207,521. Storage-Battery Compound. N. Fallek, assignor to Cook Railway Signal Co., Denver, Colo. Composed of asbestos, dilute sulfuric acid and dilute sodium silicate.

1,207,531. Automatic-Switch Controller. G. A. Fritsch, Renfrew, Ontario, Canada. Details of locking apparatus.

1,207,565. Indicating System. A. Kern, Jersey City, N. J. Electric indicating system for passing cars.

1,207,572. Apparatus for Casting Steel. E. F. Law and C. P. Sandberg, assignors of one-third to W. G. Armstrong, Whitworth & Co., Newcastle-upon-Tyne, England. Has a contact at base of mold and an arc electrode in top.

1,207,603. Electric Switch. H. J. Morey and F. A. Progden, Syracuse, N. Y. For lamp sockets.

1,207,614. Electrical-Treatment Apparatus. W. A. Olds, Medical Lake, Wash. For applying current to the human body.

1,207,618. Thermostat for Electric Heat-Regulating Systems and the Like. J. F. Otis, assignor to Minneapolis Heat Regulator Co., Minneapolis, Minn. Alarm clock shifts adjustment of thermostat.

1,207,623. Portable Electric Lamp. A. C. Recker, assignor to Waterbury Mfg. Co., Waterbury, Conn. Flashlight.

1,207,647. Speedometer. C. G. Smith, assignor of one-half to C. F. MacGill, Cambridge, Mass. Magnetic device.

1,207,653. Catenary Hanger. W. C. Starkey, assignor to Ohio Brass Co., Mansfield, O. For trolley wires.

1,207,655. Annunciator. H. A. Stevens, Buffalo, N. Y. Float-controlled alarm for tanks.

1,207,660. Automatic Safety-Stop for Line Shafts. C. D. Swett, Redwood City, Cal. Arrangement for reversing the motor tongue to hasten stoppage.

1,207,673. Machine for Making Storage-Battery Jars and the Like. T. A. Willard, Cleveland, O. Details of apparatus for compressing the material in the desired manner.

1,207,676. Railway Safe-Running Device. A. R. Angus, Minehead, England. Speed-selecting device on train co-operates with track instrument to give danger signal on train at different speeds according to direction of travel.

1,207,685. Device for Recording Telephone Conversations. G. Johnson, assignor of one-half to J. W. Graves, Richmond, Va. Phonograph is associated with telephone instrument through sound-amplifying box.

PATENTS EXPIRED.

The following United States electrical patents expired on December 12, 1916:

638,687. Electric Switch. J. M. Anderson, Boston, Mass.

638,692. Manhole for Electric Conduits. J. Banwell, Cleveland, O.

638,697. Trolley. G. W. Bolser, Lockland, O.

638,703. Electric Arc Lamp. W. J. Cochran, Le Roy, N. Y.

638,705. Electric Switch. J. L. Creveling, New York, N. Y.

638,753. Electric Gas-Lighter. F. N. Pike, New York, N. Y.

638,782. Electric Block-Signal System for Railways. L. C. Werner, Louisville, Ky.

638,788. Electric Arc Lamp. E. Woltmann, New York, N. Y.

638,789. Electric Arc Lamp. J. J. Wood, Fort Wayne, Ind.

638,833. Electric-Light Socket. L. M. Chapman and J. M. Gelatt, Louisville, Ky.

638,836. Electric Arc Lamp. W. J. Davy and G. Thomas-Davies, London, England.

638,837. Pencil for Incandescent Lamps. R. A. Fessenden, Allegheny, Pa.

638,839. Incandescent Lamp. R. A. Fessenden, Allegheny, Pa.

638,859. Switch for Electrically Propelled Vehicles. P. H. White, Indianapolis, Ind.

638,872. Multipolar Electric Motor. C. A. Lindstrom, Chicago, Ill.

638,874. Supporting Device for Battery Electrodes and Cups. R. Macrae, Baltimore, Md.

638,893. Electromechanical Indicating and Recording Apparatus. C. E. Vernon, London, and A. Ross, Sutton, England.

638,895. Electrical Tree. G. H. Wallis, San Francisco, Cal.

638,901. Magnetic Actuator. D. Bacon, New York, N. Y.

638,917. Process of Producing Wire Bars. E. Emerson, Providence, R. I.

638,933. Electric Generator for Gas-Engine Igniters. B. McInnerney, Omaha, Neb.

638,966. Electrically Propelled Vehicle. R. M. Hunter, Philadelphia, Pa.

638,986. Target. E. F. G. Pein, Hamburg, Germany.

638,992. Indicator for Elevators. H. Rountree, Chicago, Ill.

639,019. Electric Clock. J. Butcher, Jersey City, N. J.

639,053. Electric Recording System. C. L. Jaeger, Maywood, N. J.

639,062. Electromagnetic Apparatus for Separating Ores. E. Kreuser, Mechernich, Germany.

639,124. Electric Alarm or Signal. H. Wild, Johnstown, Pa.

639,127. Switch for Electric Traction Systems. O. Zoedicke, Muhlhausen, Germany.

639,170. Means for Controlling Electric Heaters. E. E. Gold, New York, N. Y.

639,186. System of Automatic-Telephone Exchanges. G. Seligmann, Paris, France.

639,195. Electric Switch. W. Ely, Providence, R. I.

639,202. Signaling System and Apparatus for Electric-Trolley Railways. W. R. Stearns, Portland, Ore.

Reissue 11,794. Electric Switch. J. E. Sayles, Montclair, N. J.